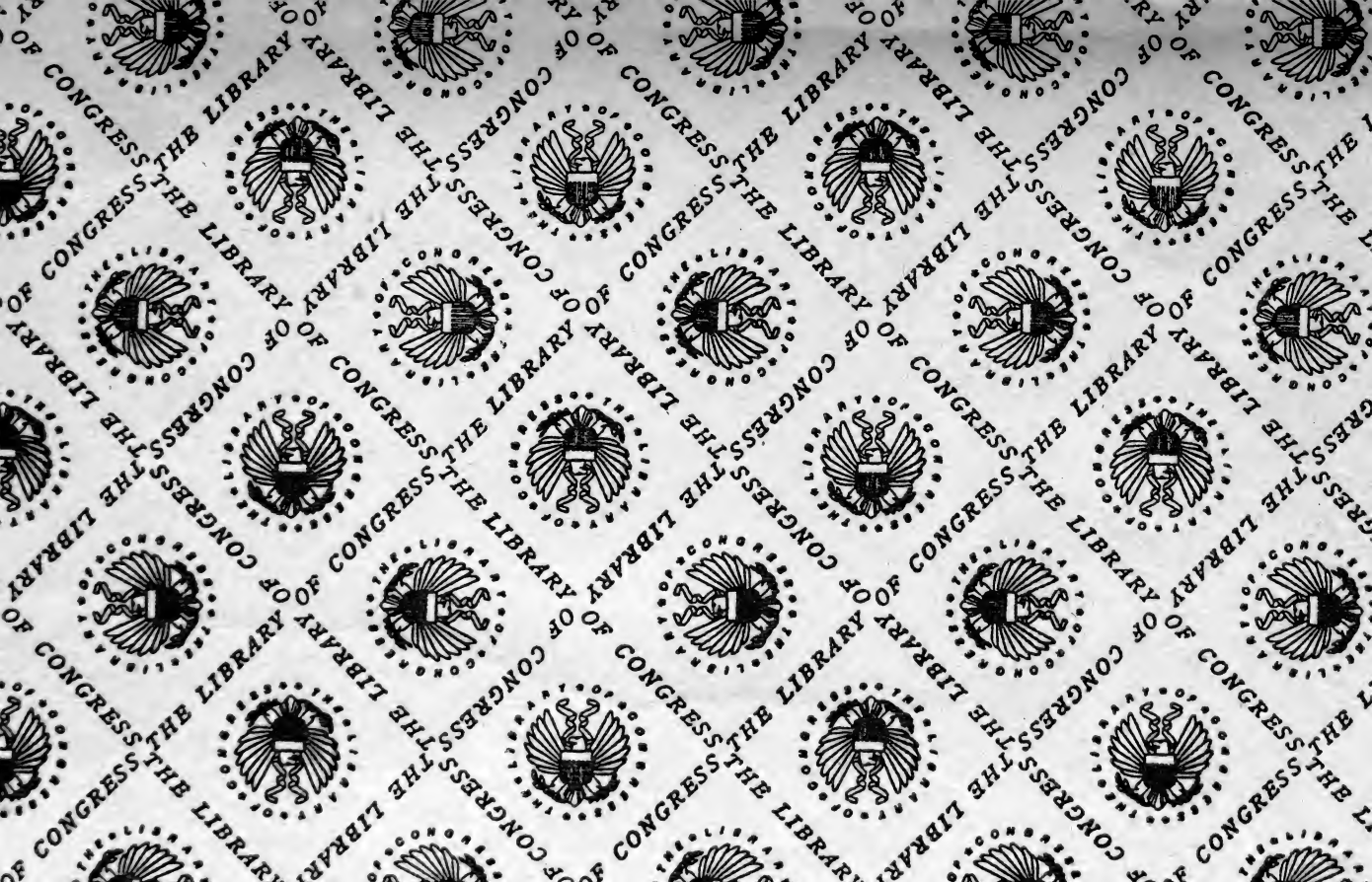

THE LIBRARY OF CONGRESS

STUDY OF FABRICS

HOME ECONOMICS SERIES

STUDY OF FABRICS

BY

ANNABELL TURNER

INSTRUCTOR IN HOME ECONOMICS,
EXTENSION DIVISION, UNIVERSITY OF WISCONSIN

ILLUSTRATED

D. APPLETON AND COMPANY
NEW YORK LONDON
1918

Printed in the United States of America

PREFACE

THE object of this book is to give the reader a knowledge of the various textile fibers, their properties in regard to warmth and hygiene, their cleansing and laundering possibilities; and such understanding of the processes of manufacture as will enable her to judge, intelligently, good and bad materials, adul terations, prices, weaves, etc. Upon woman devolves the responsibility of the economical expenditure of the family income; it is her duty to know that she is receiving the worth of her money, and, yet, most women are dependent upon the word of the clerk, very often far more ignorant than the purchaser. The standard of materials will never be raised to its proper level, until the consumers are intelligent enough to make the demand.

A detailed study is made of each of the common textile fibers used for household purposes—cotton, linen, wool, and silk—taking up the growth, manufacture, physical, and chemical properties with special emphasis on the practical household tests which may be used in detecting adulterations and judging of the quality. Laundry problems are discussed at some length dealing with the cleansing agents commonly used in the laundry and the principles which should govern a choice of the method best suited to individual conditions. Removal of stains and dry

cleaning are treated in a simple, untechnical way. One chapter deals with the economic side of the clothing problem. Suggestions are given as to the most economical ways of spending the clothing allowance, the proportion of the income which should be spent for clothing, and there is some discussion of clothing budgets. Only pre-war prices are given in this book and they can be considered only as a basis of comparison.

ANNABELL TURNER.

CONTENTS

CHAPTER		PAGE
I.	Cotton	1
II.	Wool	30
III.	Tests for Woolen Materials	51
IV.	Silk	66
V.	Linen	90
VI.	Laundry Problems	104
VII.	Hygiene of Clothing	141
VIII.	The Economics of Clothing	163
	Index	195

LIST OF ILLUSTRATIONS

PAGE

Girl spinning 2

Throwing the shuttle through the warp shed by hand 4

A cotton boll unopened 8

A cotton boll opened 10

Types of cotton fibers 13

Cotton, mercerized and stretched, showing incomplete mercerization 19

Comparison of different varieties of wood . . 31

A pair of hand cards 36

Woolen goods as it comes from the loom. Same, after shrinking. Teasel 39

A woolen yarn untwisted. A worsted yarn untwisted 41

Poor quality shoddy. Better quality shoddy . 45

Warp and woof threads exposed separately . . 55

Materials before and after boiling in the lye solution 57

Materials before and after boiling in the lye solution 59

LIST OF ILLUSTRATIONS

PAGE

Materials before and after boiling in the lye solution 60

Silkworm culture 67

Reel in operation 71

Reeled and waste silk 71

Weighted silk above, pure silk below, before and after burning 83

Weighted silks before and after burning . . 84

Weighted silks before and after burning . . 85

Pure silks before and after burning . . . 86

Chardonnet silk fibers 88

Flax in different stages of its preparation for weaving 91

Flax fibers 97

THE STUDY OF FABRICS

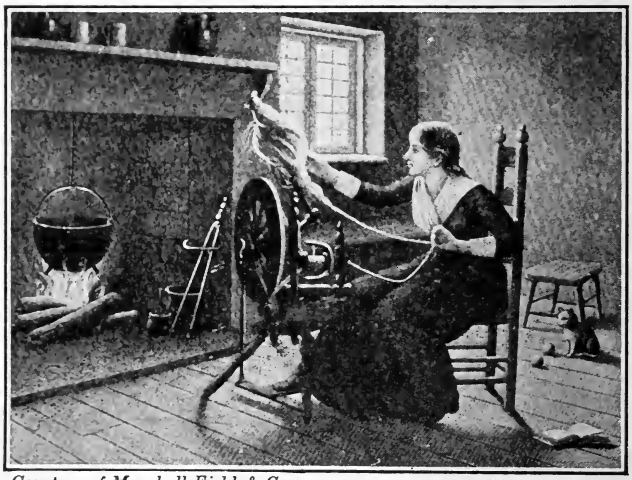
CHAPTER I

COTTON

Evolution of Spinning and Weaving.—The textile art is older than man, for, long before he came upon earth, spiders and caterpillars spun their threads, birds wove their nests, and certain trees fabricated a kind of cloth by closely interweaving the fibers of their inner bark. Man gradually conceived the idea of using this bark for clothing by soaking it in water and beating it with wooden mallets to felt the fibers together. It was then dried and bleached in the sun and colored with vegetable dyes, the method of coloring being to lay a leaf or flower on the dye and, as soon as the surface was covered with the dye, to press it down on the cloth, thus fixing the design. The bark most

used for this "Tapa cloth," as it is called, was that of the paper mulberry.

Perhaps the interlacing of the barks suggested other possibilities to the people of that day, for they began rudely to weave together reeds, rushes, and twigs to form baskets and



Courtesy of Marshall Field & Co.

GIRL SPINNING

mats, expressing their conception of art and beauty by combinations of color and weave. Beautiful examples of primitive weaving are found in northern South America, Africa, and among the western Indians.

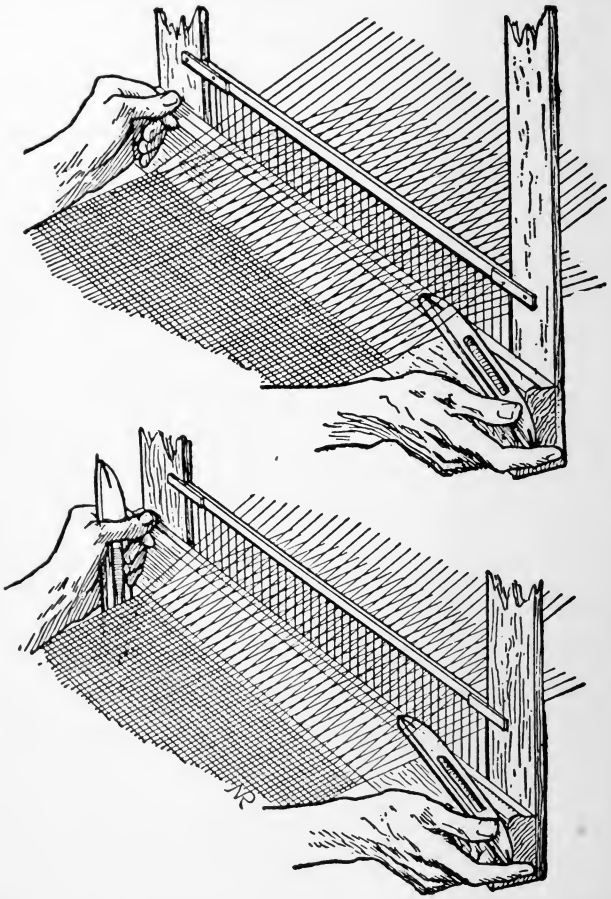
It was with the discovery of spinning yarn that the true textile art began, and although

there is no authentic information as to the actual time of the origin of spinning, we do know that it dates back before 2,000 B. C. Early nomadic tribes used threads to fasten together the skins which they used as clothing—perhaps wool torn from the sheep in passing bushes and brambles may have suggested it to them.

Until 1,500 A. D. all spinning was done by hand and a spindle, which was at first merely a stick upon which the thread was wound. Later it was discovered that the spindle could be whirled around faster if it had a weight on the end, so a piece of wood was attached to the lower end. This was called the whorl. The need of something to fasten the wool to, brought about the distaff, a stick around which the wool was wrapped and then held in the hand or tucked in the belt.

At the end of the fifteenth, or beginning of the sixteenth, century a one thread machine was invented which enabled the spinner to produce seven times more yarn than by the distaff and spindle. Gradually improvements and new inventions followed, so that today most of the spinning has been taken from women's hands and is produced by means of machinery.

The weaving of the spun yarn came as a natural sequence to the discovery of spinning. Linen cloth of exquisite fineness of thread and



THROWING THE SHUTTLE THROUGH THE WARP SHED BY HAND

evenness of weave is found in old Egyptian tombs, and the early Greeks and Romans produced woolen fabrics of great beauty and firmness. Manufacture of both wool and flax existed in Greece in the days of Homer.

The early Egyptian loom was a vertical frame similar in idea to the tapestry loom. Some savage tribes stretched the warp threads between convenient objects on the ground or from horizontal supports and wove back and forth between the warp threads as in darning. Many modifications have come since the early days but the same three steps to the process of weaving remain, whether the weaving be done on the crudest of hand looms or upon the most modern machinery: (a) shedding, the lifting of certain warp threads, thereby making a space, or shed, through which the shuttle is passed; (b) picking, passing the shuttle through the threads; and (c) battening, pressing the weft thread against the preceding ones to make the cloth firm and even.

Parts of a Loom

1. *Loom.*—An arrangement for spreading a warp and keeping it in order for weaving.

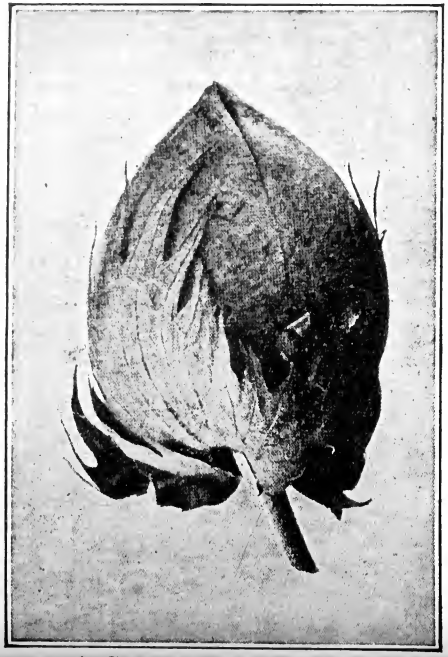
2. *Raddle.*—An implement used for spreading the warp evenly.
3. *Beams.*—(a) Warp beam, used for winding up the warp threads.
   (b) Cloth beam, used to wind up the finished, woven material.
4. *Leash.*—Loops through which threads are passed to give pattern to the weave.
5. *Heddle.*—A collection of heddles.
6. *Shed.*—The opening made in the warp for the passage of the shuttle—produced by the heddle.
7. *Shuttle.*—A tool used for carrying the weft.
8. *Reed.*—A comb-like instrument for keeping warp even and beating the weft together.
9. *Tenterhooks.*—Contrivances to hold the warp even on the sides.

Cotton.—The cotton plant belongs to the natural order of Malvaceae, or mallow family, and is known scientifically by the generic name "Gossypium." It is a shrub which reaches a height of from four to six feet, and is indigenous principally to islands and sea-coast regions of the tropics, although it can be cultivated up to about 37° on either side of the equator. A warm, humid climate and sandy soil are most favorable to its growth.

There are many varieties of the cotton plant, the most important being: (a) Gossypium her-

baceum, which grows from 4 to 6 feet in height and bears a yellow flower. The seeds are covered with a short gray down and the fiber is short. This variety is found in Egypt, Asia Minor, Arabia, India, and China. (b) Gossypium arbareum, which grows to a height of from 15 to 20 feet. The seed is covered with a greenish fur and is enveloped in a fine silky down, yellowish white in color. It is found in Egypt, Arabia, and China. (c) Gossypium barbadense, which grows from 6 to 15 feet high. The flowers are yellow and the seeds black and smooth, being destitute of the hair that characterizes other cottons. It is a native of the Barbadoes, from which it derives its name. The best quality cottons come from this species—Sea Island and Florida cottons—from which are spun the finest yarns. Long-stapled Egyptian cotton is supposed to have come from this stock. The chief cotton countries of the world in order of importance are: United States, India, Egypt and Brazil, West Indies, West Coast of Africa, Asia, Asia Minor, China, and Queensland.

In the southern states cotton is planted with a machine, the seeds being dropped in a continuous stream. When the young plant is about



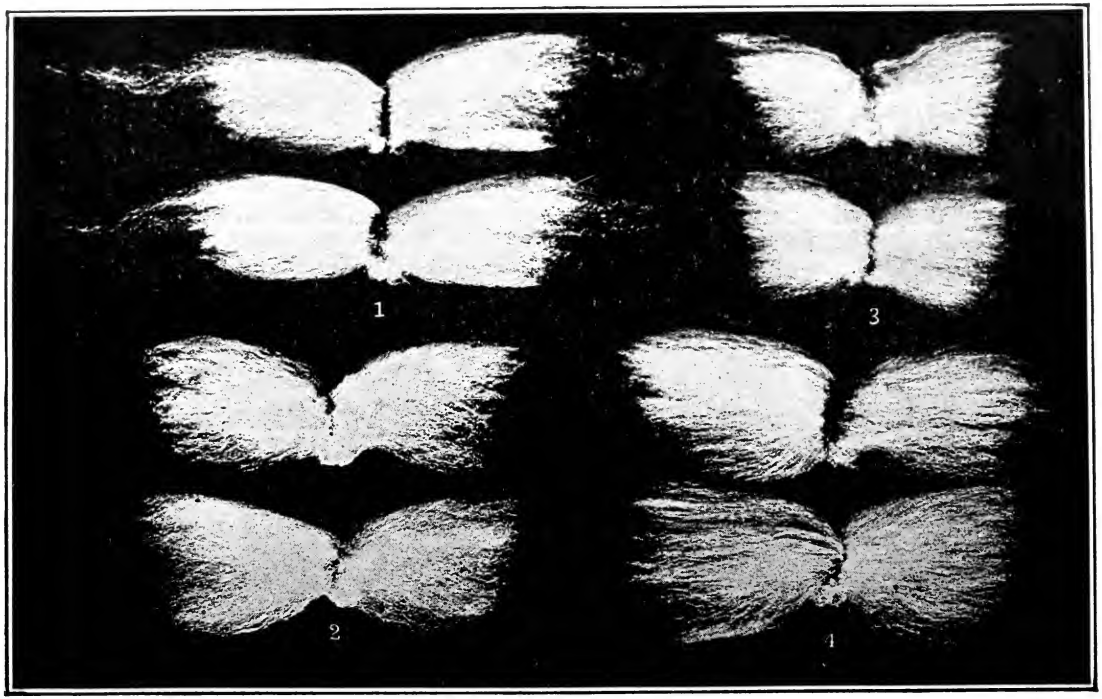
A Cotton Boll Unopened

A Cotton Boll Opened

three inches high it is thinned out with a hoe—about twelve inches being left between plants. The time for planting depends upon the latitude, beginning about the middle of March and ending the first half of May.

Ten or eleven weeks after the planting, the shrub is ready to bloom. The flower has five petals, yellow at the base and growing lighter in color at the edges. When the flower drops off, a dark green pod is seen which increases in size and finally discloses a mass of downy white fibers in which are imbedded the dark brown or black seeds. The cotton is picked as soon as ripened and separated from the seeds by a process known as ginning. The seeds are hulled and the kernel put through a hydraulic press which squeezes all the oil from it, leaving the meal, which is used as feed for cattle. The refined oil is used as a substitute for olive oil, the residue being used as soap stock.

After the cotton is ginned it is baled and shipped to the mill, the standard size of a cotton bale in the United States being 56 by 24 by 32 inches and weighing about five hundred pounds. The bales are wrapped in bagging and strapped with sheet-iron bands. When the cotton ar-



COTTON SEEDS WITH LINT ATTACHED

rives at the mill the bales are broken and the cotton starts upon its journey, passing through various processes until it is converted into yarn. The first step consists in giving the cotton a thorough cleaning, which is accomplished by a series of machines which pull the wads of cotton into shreds, beat out the dirt and any seeds left in, and finally leave the cotton in the form of batten upon the cylinders. From here the cotton goes to the carding machine where it is combed to straighten the fibers and remove any remaining foreign material and also some of the short fibers. Then it goes into the combing machine which casts aside as waste all fibers below a certain length, passing the rest on to the drawing machine where the fibers are laid perfectly straight and parallel and the cotton drawn out as much as possible without breakage. The combing process is omitted unless the cotton is being prepared for especially fine or high grade materials.

Several intermediate steps take place before the fiber is spun into yarn, the principal point of difference being the amount of twist imparted to the strand. Spinning produces the finished yarn, which is converted into thread by

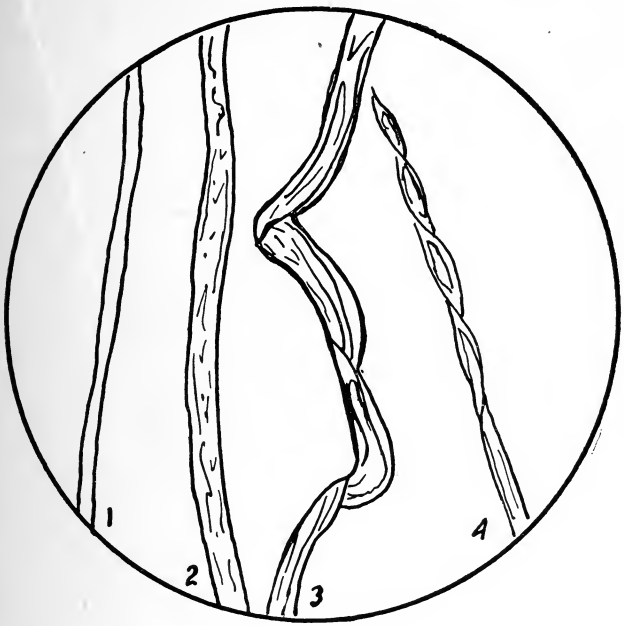
uniting two or more yarns firmly by twisting. All sizes of 6-cord threads are made of six strands and 3-cord spool cotton is made of three strands. The ordinary spool of cotton thread contains 200 yards.

Before being woven into cloth, cotton threads are strengthened by coating them with a preparation of starch, flour, paraffin, tallow, etc., to enable them to withstand the friction resulting from the weaving process without breaking. After weaving, the material is bleached, starched, and calendered, the object of the last process being to give it a perfectly smooth and even surface and also to impart a luster to the cloth as it passes through. The cloth is calendered several times, according to the finish required.

Cotton is dyed either in the yarn or in the cloth, but it has much less affinity for dyestuffs than animal fibers, and, relatively speaking, there are only a few with which it can be dyed without the assistance of a mordant.

Physical Characteristics.—Under the microscope the cotton fiber usually presents the appearance of a flat, slightly twisted ribbon with thickened edges. Physically the individual cot-

ton fiber consists of a single long cell with one end attached directly to the surface of the seed. While it is growing, the fiber is round and cylin-



TYPES OF COTTON FIBERS

1. Glossy, dead, structureless fiber;
2. Thin, transparent, flat, unripe fiber;
3. Half ripe fiber with thin cell wall;
4. Mature, ripe fiber with full twist and thick, well-defined cell wall.

drical, having a central canal running through it, but after the pod has ripened and burst the cell wall collapses, causing the fiber to form into a flat, ribbon-like band. Upon ripening, the

juices in the inner tube dry up, causing the characteristic spiral twist of ripe cotton. This spiral twist makes cotton valuable for spinning purposes as it causes the fibers to lock around each other more tightly. In diameter the cotton fiber is rather even for the greater part of its length, gradually tapering to a point at its outgrowing end. The lengths of different varieties of cotton fibers vary from three-fourths to two and one-half inches, sea-island cotton being the longest.

The hygroscopicity, or power to absorb water without feeling damp, is between six and eight per cent of its weight. Cotton which has been freed from the natural vegetable wax is more hygroscopic, and is known as absorbent cotton.

Linen has the greatest power of heat conduction and cotton ranks second. Materials made from linen are, therefore, the coolest and cotton materials come next.

Though resistant to the action of moths and insects in general, cotton is liable to undergo fermentation, as is evidenced by the formation of mildew on cotton fabrics stored in warm, damp places.

Chemical Nature of Cotton.—In its chemical

composition, cotton consists almost entirely of cellulose, on the surface of which is a protecting layer of wax which is removed in one boiling out and bleaching process performed previous to the dyeing and printing of the cotton.

Effect of Chemicals on the Fiber.—Organic acids and their salts, such as acetic acid in vinegar, oxalic in rhubarb, tartrates in grapes, and citrates in lemons, even when moderately concentrated, do not appear to have any injurious effect upon the cotton fiber unless they are allowed to dry on the fabric and are afterwards moistened and ironed dry with a hot iron. The destructive action is not so much of a chemical nature as mechanical, it being caused by the acids crystallizing within the fiber and breaking the cell wall. Dry heat in connection with organic acids is more injurious than moist heat. Very dilute solutions of mineral acids, if cold, have no appreciable effect upon cotton, but if the fiber is impregnated with such a solution and allowed to dry rapidly it becomes tender due to the concentration of the acid induced by the evaporation of water. Heat will cause dilute mineral acids to attack the fiber much more readily than otherwise. In all dyeing and

bleaching operations, therefore, where the use of acid may be required, the temperature of the acid baths should not be above 70° F., nor should a solution greater than two per cent be used. Organic acids should be substituted for mineral acids wherever possible, and all of the acid should be removed from the cotton or neutralized before drying or there is danger that the material may be ruined.

Action of Alkalies on Cotton.—Alkalies have a very different effect upon the cotton fiber from that of acids. Under ordinary conditions they are harmless. Dilute solutions of either the carbonated or caustic alkalies even at a boiling temperature have little if any injurious effect on the cotton fiber.

Concentrated solutions of caustic alkalies have a peculiar effect upon cotton. If the fabric is immersed for two minutes in a strong solution of caustic soda and is then removed at once and washed free of the alkali, it is found to have shrunken greatly and to have become much closer and firmer in texture, the cloth having actually been strengthened by the shrinkage. Long-continued action in concen-

trated alkaline solutions, however, will gradually destroy the cloth.

Bleaching Agents.—Formerly linens and cottons were bleached entirely by slow oxidation due to action of water, air, and sunlight, but various artificial bleaching stuffs have been discovered which hasten the process and save both time and labor. A common household bleach, chloride of lime (a "bleaching powder") is a compound of chlorine (a gas) with calcium oxide. This powder has the power of destroying colors and stains at once but it also attacks the fibers of the material unless the action is neutralized by rinsing the cloth in some alkaline solution. Ordinary household ammonia, or hyposulphate of soda will do this satisfactorily.

The can in which the chloride of lime is kept should not be allowed to stand uncovered, as the chemical will rapidly lose its strength.

Another bleaching agent much used for household purposes is Javelle water, which is similar to "bleaching powder" except that soda replaces the lime. It is prepared by dissolving 1 lb. of washing soda in a quart of boiling water, allowing it to cool. Then half a pound of bleaching powder is dissolved in two quarts of

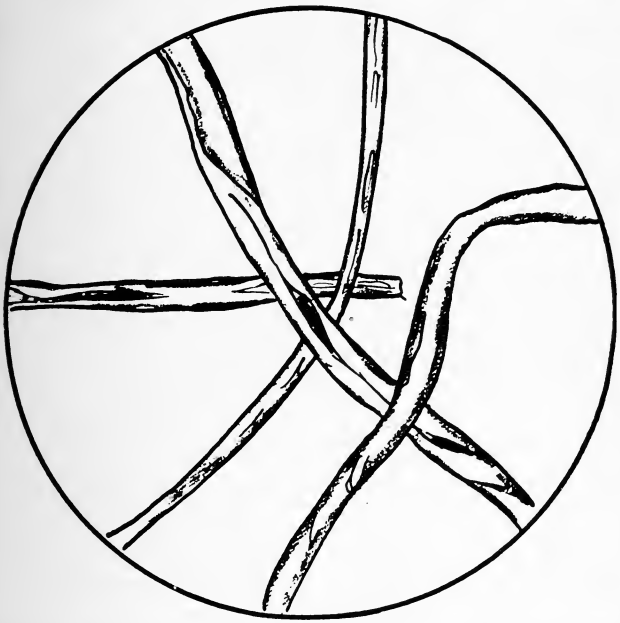
cold water, allowed to settle, and the clear liquid added to the soda. The whole is strained off, bottled, and kept in a dark place. As in using bleaching powder, rinsing in a neutralizing solution is necessary. Both should be kept in glass bottles having glass or rubber stoppers.

Mercerized Cotton.—The process of mercerization is named after John Mercer who discovered in 1844 that cotton might be given a high degree of luster and at the same time be strengthened by subjecting it to the chemical action of caustic alkali and a strong tension to prevent contraction.

When the cotton fiber is placed in the caustic solution it undergoes a peculiar physical modification, changing from the flat, twisted, ribbon-like shape to a smooth, rounded, cylindrical fiber with thickened cell wall. The tensile strength is greatly increased, amounting in some cases to from 30% to 50%.

Mercerization imparts a high luster to the cotton fiber, due partly to the fact that the fiber, being cylindrical, reflects the light instead of absorbing it, and to another condition which affects the lustrous appearance, the change in the cell elements. The substance becomes gela-

tinous and translucent, thereby affecting the optical properties of the fiber and lessening the amount of light absorbed. Ordinarily the process of mercerization is not continued until every



Cotton, Mercerized and Stretched, Showing Incomplete Mercerization

fiber is completely mercerized. The illustration, which is typical, shows part of the fibers still containing a partial twist.

Mercerized cotton is somewhat more reactive towards dyestuffs than other cottons.

Yarns of ordinary grades of cotton cannot be mercerized successfully, and as the cost of producing high grade mercerized yarn is about three times that of the same quality of unmercerized cotton, the higher cost of the finished product may readily be understood. Long-stapled sea-island cotton and Egyptian varieties are usually selected for the manufacture of mercerized materials, as they are better able to withstand the tension necessary for the perfection of the process than the short-stapled fibers.

Cotton may be mercerized either in the yarn or in the cloth, although it is usually done in the yarn.

Silk Finish.—Both mercerized and unmercerized cottons are often calendered to increase the luster of the material. The cloth is passed between rollers, under heavy pressure, one roller being engraved with obliquely set lines (125-600 to an inch). The larger number of very fine parallel surfaces reflect the light producing a beautiful silk like luster.

Unmercerized cotton which has been finished this way is no stronger than ordinary cotton. To distinguish between the mercerized material and goods which has been merely calendered

place a piece of the material under the lowest power of the microscope and turn it backward and forward. Look for press lines on the fibers.

A Test for Mercerized Cotton.—Wash the samples, rinse well, and when dry compare with a piece of the same which has not been washed. If the luster remains, the material was mercerized. The finish put on by sizing material, pressure, and calendering is removed by washing.

Experiment.—Select a number of samples of cotton materials which have a lustrous finish and use the test given above to determine which are mercerized and which have simply been treated to make them appear mercerized.

Dyeing.—Dyestuffs are classified in general as acid, basic, substantive, and mordant dyes. The acid dyes may be used to dye animal fibers directly—that is, without the use of a mordant. Basic dyes are used directly on animal fibers and may be used on cotton if tannin is used as a mordant. The substantive dyes will be absorbed by both animal and vegetable fibers, although they are usually used on cotton. The mordant dyes require a metallic mordant for both animal and vegetable fibers.

The word mordant comes from a word mean-

ing "to bite." It is a substance which will unite with the fiber and also with the dye to be used.

Silk and wool have both acid and basic properties and, therefore, the acid and basic dyes may be used directly on these fibers. As cotton and linen are inactive chemically, these dyes will not unite with the vegetable fibers unless a mordant is used. This accounts for the fact that cotton and linen are more difficult to dye than wool or silk.

Natural dyestuffs are no longer used commercially to any extent. The following are used occasionally: Madder for red, logwood with fustic for black, cutch for brown, and indigo for blue. Madder and indigo are now produced artificially instead of being obtained from their natural sources. This has reduced their cost materially.

The usual process of dyeing is, first, to treat the cotton goods with a mordant (various salts of aluminum, chromium, iron, tin, and copper), fixing it on the fiber by means of tannin or an alkali. The mordanted cloth is put into a dye bath and boiled one or more hours until the desired shade is obtained. The salts of aluminum are used as mordants for the light shades and

iron for the dark ones. In general, chromium mordants give fastest dyes. Aniline dyes, made from anilin, a coal-tar product, are largely used at the present time, and if care is taken in their use, prove satisfactory. The commercial dyes which may be purchased for home dyeing are derivatives of coal-tar products and good results may be obtained if the directions are followed carefully. The colors are more permanent than those obtained with the natural dyes.

Printing.—Block printing was first used, the design being engraved in relief on blocks of wood. These were dipped in the colored paste and applied to successive portions of the cloth by hand. These blocks are now replaced by engraved copper rolls, the design being such that it is repeated once or a number of times in each revolution of the cylinder. There is a printing roll for each color of the design. Sometimes both the background and the design are printed on the cloth, but the more common process is for the design only to be printed on the cloth, which may be dyed afterwards. In the paste of the printed design there is some chemical which prevents the portions printed from taking the dye, consequently these remain white or a dif-

ferent color as the case may be. This is called the "resist" process. Another process is to first dye the cloth and then print on some chemical which, when the calico is steamed, discharges the color. This is called the "discharge" process. Sometimes this weakens the goods in many places where the color has been discharged. This accounts for the dropping away of dots and also the giving way of white stripes in printed materials. The color paste contains both the dye and the mordant. After calico has been printed it is steamed to develop and fix the color, washed to clear the whites, usually sized, then pressed and dried by passing over slowly revolving, steam heated drums. In general the colors in printed materials are not so fast to washing and sun as are those dyed in the piece or yarn.

Common Cotton Materials

Gingham.—Cotton dress goods woven of plain dyed yarn, usually in checks, plaids, or stripes

Muslin.—White, firmly woven material suitable for underwear and sheeting

Calico.—Material with a figured design printed on one side

Cambric.—Fine material used for dresses, usually white, but sometimes printed on one side

Batiste.—Fine dress material, either white or printed

Dimity.—Sheer, fine material, corded lengthwise, usually, but sometimes both ways

Sateen.—Cotton fabric with a glossy surface somewhat resembling satin

Piqué.—Heavy fabric, corded either lengthwise or crosswise, used for waists and suitings

Mull.—Thin, white, wiry fabric used as a dress material

Nainsook.—A soft, white, cotton fabric used for infant's clothing, lingerie, dress goods, etc.

Organdie.—A fine, sheer, wiry dress material, either in plain colors or printed designs

Percale.—A firm material used for skirts and dresses, usually printed on one side

Scrim.—An open weave used for curtains

Corduroy.—A cotton material resembling velvet but woven with a ribbed effect

Velveteen.—Cotton velvet which has a loose pile on the surface

Testing for Fastness to Sunlight.—Cover one end of a sample of material with a piece of heavy cardboard and expose the uncovered end to the sunlight for a number of days, examining it in the shade to see if the exposed end has changed in color from that of the covered part. Note the number of days it takes to change the color. Fabrics that are but slightly changed at

the end of a month are called "fast," "moderately fast" colors are those but slightly faded in 14 days, and those which are more or less completely faded in 14 days are called "fleeting."

Testing for Fastness to Washing.—Fabrics should withstand the action of soap, the heat, and the mechanical friction necessary for laundering. To test the fabric wash it in a soap solution similar to that used in the household, not warmer than 131° F. Repeat several times, and if the color does not fade it is "fast" to washing.

Testing for Crocking.—Many dark colored cottons which have been poorly dyed discolor other garments or the skin. Materials may be tested easily by rubbing them briskly on white unstarched cotton fabric.

Testing for Fastness to Perspiration.—The fabrics which come in contact with the body are often weakened by perspiration unless a good resistant material is used. To test the fabric for resistance, place a sample in a bath of 25% to 40% acetic acid warmed to the temperature of the body, 98.6° F. Dip the sample a number of times and dry without rinsing between clean

blotting papers. Note whether or not the color is affected.

Testing for Percentage of Shrinkage.—Pour boiling water over a sample and leave it immersed over night. Dry at a moderate temperature without stretching. Press. Measure before and after treatment. Try samples of lavender, pale blue, pink, green, and brown, to show: (a) Fastness to sunlight. (b) Fastness to laundering.

Wearing Qualities Compared with Price.—Cotton, being cheapest, is not adulterated with any of the other fibers, but an inferior grade of material is often made to appear heavier by the addition of dressing. Starch, glue, dextrine, etc., are used, and they may add greatly to the weight of the cloth. The spaces between threads are filled and a good finish is given to the material, but after washing, the cloth loses both in weight and firmness. This dressing may be detected in thin fabrics by holding them up to the light, then the starch will show between the threads. It may also be detected by rubbing the material in the hands when it is freed from part of the dressing and the firmness of the cloth may be determined. Still another method of

determining the amount of sizing present is that of washing a sample of the material thoroughly and comparing it with the original.

If material is to give good service, the warp and weft threads must be in good proportion. Materials having some heavy threads, as dimities, or having a much heavier warp than weft are apt to split owing to the unequal tension. Materials which have been on the market for some time may have become weakened by the action of the chemicals which were used in the bleaching or in the sizing.

The strength may be judged by the following test: Place the thumbs together and press them down hard on the material, holding the cloth tight underneath. Consider the amount of strain resisted.

In choosing between two grades of the same type of material, consider the additional wearing qualities obtained for a slight additional cost. Often a piece of material costing two or three cents more will wear twice or three times as long as the cheaper material. This is not always true, however, as sometimes a large part of the price is represented in the novelty of weave, design, or color. Obtain three sets of

samples of different types of cotton materials which illustrate the above, and study them carefully.

The firmness of the weave and the quality of the fiber are always important factors to consider. To judge the quality of fiber, untwist a thread of the cloth and notice the length of the separate fibers. A long fiber indicates strength and, therefore, good wearing qualities, other things being equal.

Always consider width as well as price in comparing two pieces of material. The wider material will usually cut to better advantage, and may, therefore, be more economical.

In purchasing dotted Swiss be sure to determine whether the dots are embroidered or merely printed or pasted on. Printed dots are more likely to fade and those made of paste become discolored by ironing and wear off.

CHAPTER II

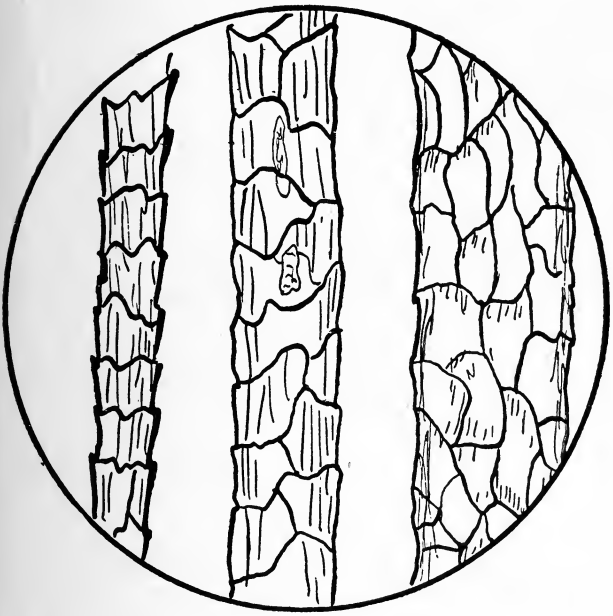
WOOL

Wool.—The soft, curly covering of sheep and of similar animals, has been used from earliest times, and its production and value are increasing steadily. Unfortunately the production is not keeping pace with the increasing demand, as will be explained later.

The great wool producing countries are Australia, South America, the United States, and South Africa. Wyoming, Montana, Idaho, and Oregon produce the largest part of the wool raised in the United States. Australia is the largest producer of the finest wool, although Ohio, Pennsylvania, and West Virginia furnish a fine quality which is a close rival.

The quality of the wool depends upon the breed of the sheep, feed, care, climate, and the part of the animal from which it comes. The best wool in soundness of fiber, softness, and evenness of length comes from the shoulders

and sides of the animal. The various kinds of wool used in commerce are named either from the breed of the sheep or the locality in which the sheep is raised, as: Australian wools, New



Comparison of Different Varieties of Wool

Zealand wools, Cashmere, Shropshiredown, and Merino wools.

The wool fiber is composed of three parts which may be seen under the microscope:

(a) Epidermis, or outer surface, which is

composed of overlapping scales, similar to those on a pine cone.

(b) Cortex, which consists of a layer of cellular fibrous substance, which gives the fiber its chief strength and elasticity.

(c) Medulla, or marrow of the fiber.

The scales give wool its peculiar felting property, due to the interlocking of the projecting edges of the scales—the deeper the scales fit into one another, the closer becomes the structure of the material. This property is taken advantage of in the manufacture of such materials as broadcloth. It is also this property which necessitates extra care in the laundering of woolen materials to prevent shrinkage which is simply another name for the interlocking of the scales.

The difference between hair and wool is largely in this layer of horny scales. On hair they are much less marked, and often do not project at all at the edges. The distinction is sometimes made that hair is straight and wool is curly, or that hair is stiffer than wool; but here again the difference is sometimes greater between the extremes of wool or the extremes

of hairs than between a given wool and a given hair.

The amount of luster which wool has also depends on the scales. If the edges of the scales are rough and uneven, the fiber as a whole will not be so smooth and lustrous as a fiber in which the scales are more nearly regular and reflect the light evenly. The fiber from the Angora goat, which has less prominent scales, has greater luster than the wool from most sheep, but there is also greater variation in different breeds of sheep.

The length of the wool fiber varies from one to eight inches, depending upon its location on the animal and upon the breed. The wool fibers may be roughly classified as long-staple wools or "tops" from which worsteds are ordinarily made, short-staple wools used in the manufacture of woolens, and the miscellaneous or carpet and blanket wools.

This classification is based on the length, fineness, and felting qualities of the staples.

The hygroscopicity of wool, the property of absorbing water without feeling wet, is greater than that of any other textile fiber. It varies

in different wools from eight to fourteen per cent.

In elasticity it is next to silk. This is the property which makes woolen materials keep their shape better than linen or cotton.

Wool is a poor conductor of both heat and electricity; therefore, it keeps the body evenly warm and prevents rapid cooling. It feels warm to the touch because it does not conduct the heat away from the body. Woolen shirts are worn by men working around furnaces because the wool forms a blanket of air spaces which hold warmed air and moisture, thus preventing the extreme heat from reaching the body.

The tensile strength varies so greatly that no definite statement can be made.

Dilute acids have no appreciable effect on wool. Concentrated acids totally destroy it. With organic acids wool is usually reactive, readily absorbing oxalic, tartaric, acetic, and such acids.

Wool is quite sensitive to alkalies, so much so that a 5% solution of potassium or sodium hydroxide, at a boiling temperature, will, in fifteen minutes, completely dissolve the fiber.

The use on wool of a strong soap, which means a soap containing a large amount of free alkali, increases its shrinkage, for it softens the fibers and causes the projecting scales to become more prominent, thereby inducing a greater interlocking of fibers, with the consequent thickening of the material and decrease in the size of the garment. Dilute solutions of borax, ammonia, or a neutral soap if used at a low temperature have little, if any, injurious effect. Another point to remember in the laundering of wool is to keep the temperature as nearly as possible the same throughout the washing and drying. The alternate expansion and contraction of the scales caused by different temperatures increases the interlocking and, therefore, the shrinkage.

Wool is the most reactive of all the textile fibers to coloring matter. Consequently it may be dyed easily and the colors are usually "fast."

Shearing in the United States is usually done by experts who begin work in Southern California, Texas and neighboring states about May and work on up through Wyoming, Montana,

Idaho, Oregon, and then into Canada, in this way being busy most of the year.

Most of the wool on the market comes in the form of fleece wool, the product of one year's growth. The fleeces are rolled in bundles as they come to the mill, and are sorted according to quality and length of fiber, the wool from the shoulders and sides being, usually, the choicest part of the fleece. After sorting, the wool is washed to remove the grease and dirt; dried and oiled to render it soft; burred and carbonized to remove seeds, leaves, and burrs; and blended, by which means a more even yarn is produced. After the wool is blended it comes out in a soft, fleecy condition, ready to be carded.

The carding machine finishes the cleaning, separates and straightens the fibers, and delivers the wool in soft strands called slivers.

If the wool is to be used for worsted material it must be further straightened and have the short ends or "noils" removed by a process called combing. This leaves only the good long fibers lying practically parallel to each other.

The combing process is unnecessary in the manufacture of woolen materials as the yarns

A Pair of Hand Cards

are composed of short fibers which cross and are somewhat matted.

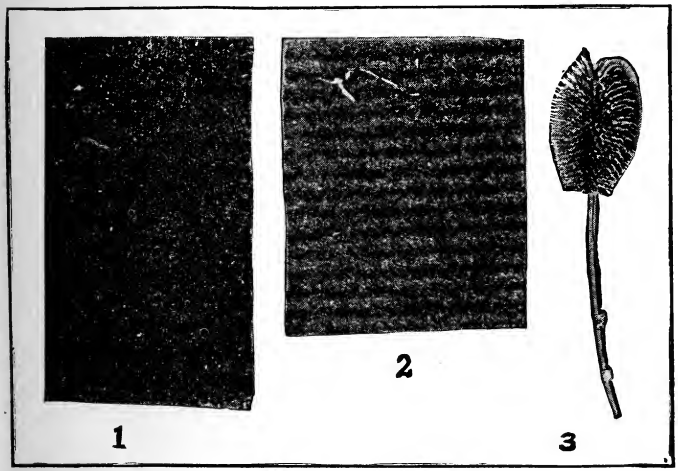
The processes of drawing and spinning draw out and twist the long soft rolls until the thread is reduced to the size required.

Before weaving, the warp yarn is sized by a starch preparation to enable the threads to withstand the friction due to the constant weaving back and forth of the weft thread. It is then placed on the loom, the warp running lengthwise. The filling thread, or weft, is wound on a bobbin, which is fastened in a shuttle, allowing the thread to unwind as it is passed back and forth. As fast as the weft passes through between the warp threads, which are separated in different groups to form the pattern, it is beaten up tight against the preceding thread, thereby keeping the cloth firm and even.

Dyeing is done either in the yarn or in the piece, the piece-dyed materials being of a single color, while wools dyed in the yarn allow various combinations.

When cloth comes from the loom, it is in an imperfect condition for use; knots tied in the thread are carefully drawn to the surface and clipped off; threads are woven in where any

have been left out; repairs are made if necessary. This part of the finishing must be done very carefully for worsted materials as the imperfections will not be covered by a napped surface as in woolen materials. The beauty of



1. Woolen Goods as it Comes from the Loom. 2. Same, After Shrinking. 3. Teasel.

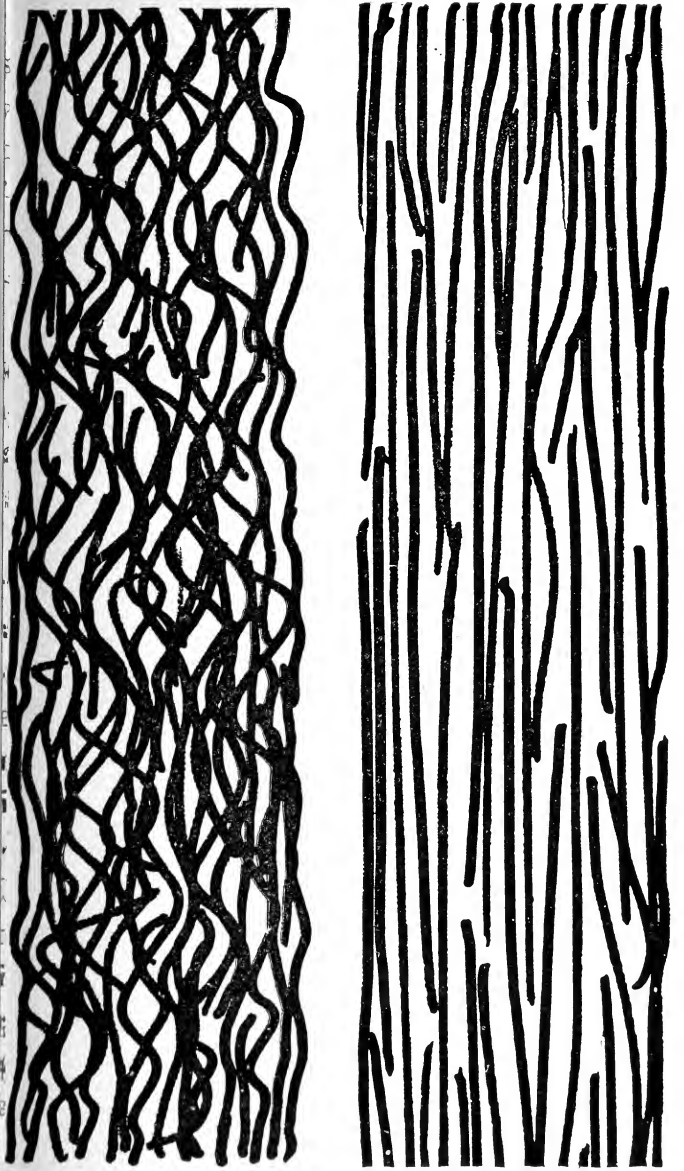
woolen goods lies largely in the finish of the cloth; and of worsted goods, in the weave, while the object of fulling woolen materials is often to obliterate it entirely. The cloth is pressed over a heated roll to give it a permanent finish and luster before it goes to the retailers.

The finishing of a material such as broadcloth, where the weave is entirely covered by

a napped surface, is an interesting process as it shows the severe treatment which is necessary to obtain the highly lustrous finish. This in turn throws light on the high price of good chiffon broadcloth, as a good quality of wool must be used to withstand the treatment, and the extra labor also adds to the cost.

The cloth as it comes from the loom is loosely woven and much wider than desired when finished. It is then churned in hot soap solutions to felt or shrink the material. This process is repeated until the desired result is obtained.

Napping, which raises the ends of the fibers on the face of the cloth, is done by means of a wire teasel gig. The teasel, a seed receptacle of a vegetable, is about the shape of a pine cone, and it is interesting to note that no mechanical contrivance has ever been invented to equal it for the purpose. The nap which has been raised by the teasel is sheared or cut to a proper length by a machine which works like a lawn mower. The cloth is pressed, and, if a high luster is desired, it may be necessary to repeat the napping and shearing before it is wound upon copper cylinders and steam is forced through it at a high pressure.



Woolen Yarn Untwisted A Worsted Yarn Untwisted

The difference between worsteds and woolens is principally that in the threads or yarns from which worsteds are made the fibers of the wool lie parallel to one another, combed wool being used from which the short fibers have been removed; and woolens are made from yarns in which the fibers cross and are matted and intermixed. When finished, the effect of worsteds and woolens is materially different. Upon examination it will be found that a worsted thread resembles a wire in evenness, while the woolen thread is uneven and irregular.

A worsted fabric when finished has a clear, bright, well-defined pattern, and seems close and firmly woven; while woolen cloths are softer, they are more elastic, the colors are more blended, the threads are not so easily distinguishable, and there is a duller effect in general.

Owing to the rapidly changing fashions today, dress materials are frequently cast aside when only partially worn. This naturally greatly increases the demand for new fabrics and, therefore, for raw wool.

Statistics from 1909 give approximately 220,000,000 lbs. as the amount of new wool, freed from grease, used in the United States. Later

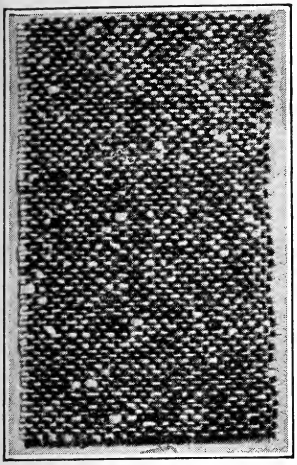
figures show that about 250,000,000 lbs. are used a year at the present time. Estimating the present population as about 90,000,000 the amount of raw wool per capita is less than three pounds. Considering the waste in manufacture (100 lbs. of raw wool being required for 85 lbs. of cloth), and also the proportion which must be used for blankets, carpets, rugs, felts, and upholstery, it is apparent that the supply of new wool is not equal to the demand. To make up for this shortage, shoddy and cotton have come into general use.

Shoddy is the term which has come to be applied to all reclaimed wool which has already served one or more periods of usefulness. The term is unfortunate as it suggests only deception, sham, and fraud. No objection is raised to the use of other waste product, so why should there be in this case? The only just cause for complaint is found in the abuse rather than the use of the so-called shoddy.

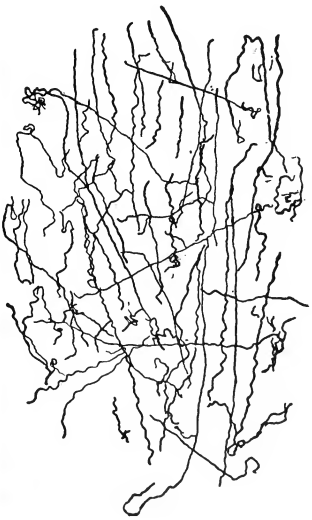
The wool is reclaimed from wool rags, tailors' clippings, and scraps of various kinds. These are dusted, cleaned, and then torn apart by machines designed especially for that purpose. If any cotton is present, the mass is

treated with dilute acid to decompose the vegetable matter, leaving only the wool. This is washed, dried, and carded, preparing it for spinning a second time. The quality of the shoddy depends upon the quality and value of the material from which it is made. The best quality is obtained from knitted goods and worsted materials, if good wool was used in the first place. To be sure, it is not so strong as it was originally. The strain undergone in the various processes through which it has passed has weakened the fibers to a greater or lesser degree. Yet in many cases it is not "worn out" by any means. The much felted woolen materials give the short inferior fibers. It has been said that, "Anything with two ends may be spun." When we find fibers not more than a fourth of an inch in length we realize the truth of that statement and wish the manufacturers were a little less clever. These short fibers soon become loosened or wear off, leaving the garment "threadbare" as we say.

The better quality may contain good long fibers ready to do good service again. The processes through which it has gone thoroughly sterilize the material, so there is no possible



Poor Quality Shoddy



Better Quality Shoddy

danger of contamination. We may not like the idea of wearing clothes made from material which has been used by someone else, but the prejudice is not justified, as the use of these reclaimed materials has clothed many people much more cheaply and warmly than would otherwise be possible. In fact, it is the only way in which the insufficient supply of new wool may be pieced out and made to go around. Should this material be wasted, many persons would be unable to afford proper clothing, as it is difficult to estimate what the price of wool would be. To quote from an article in a trade journal: "This is no excuse for dishonesty, false labeling or misrepresentation. Good, honest, sound, and well wearing cloths can be made, are made, and sold on their merits at prices 'within the reach of all' and all that is needed is that they may be represented for what they are, in the name of common honesty."

Because there will always be unscrupulous manufacturers who will misrepresent their goods, there should be pure textile laws requiring proper labeling of all materials. A copy of one of the specifications used by the War Department in ordering materials for the army

gives us an idea of textile standards. Until such laws are secured we must learn to judge for ourselves or expect to be cheated occasionally. As a usual thing, when paying a reasonable price for wool materials in a reputable store, good value may be expected. There are exceptions, however, which will be cited later.

Cotton is also used quite largely in the manufacture of woolen and worsted materials to help make up for the shortage in wool. The cotton is mixed with the wool in the following ways:

(a) Cotton combed with the wool and spun together.

(b) Cotton covered with wool so that the cotton is not visible.

(c) Cotton used alone as the warp or weft threads, usually the former.

(d) Cotton threads twisted in with the wool.

Specifications of War Department

War Department

Office of the Quartermaster-General.

Specifications for olive drab worsted kersey, 16-ounce

Wool.—For warp and filling: To be American, shorn from live sheep, free from kemp, of not lower

grade than high half-blood, staple to be of good character, sound, true and well conditioned, possessing in addition all the necessary qualities to produce the hereinafter-described requirements. The admixture of wastes, reworked wools, vegetable fibers, or other impurities is prohibited. (Broken sliver from the combs and drawing frames made at the time this yarn is being manufactured not to be considered waste.)

Color.—To be a mixture of an olive drab shade, as represented by the sealed standard sample. The various colors required to form this mixture may be dyed in the wool, slubbing, or top, as desired, and to be reasonably clean before mixing. The colors must be sufficiently fast to withstand milling, perspiration, and climatic influences, such as sunlight, air, and exposure incident to the military service.

Tests.—All deliveries shall be subjected to the following official tests, chemical and otherwise:

(a) Boiling for ten minutes in a solution composed of 80 grains of neutral soap to one pint of water.

(b) Boiling for ten minutes in a solution containing 10 grains of dry carbonate of soda to one pint of water.

(c) To stand an exposure to the weather (roof test) for thirty days.

(d) Soak for twenty-four hours in lactic acid, specific gravity, 1.21 U. S. P. Temperature about 70° F.

(e) Soak for twenty-four hours in a solution composed of three drams (avoirdupois) of citric acid to two fluid ounces of water. Temperature about 70° F.

To judge results correctly the specimens that have been subjected to the above acid test must be washed

with soap in warm water. In all these tests no greater changes of color must take place than would be shown under similar tests made on the sealed standard sample.

The regulation size of the above samples shall be six (6) by four (4) inches. In making tests "d" and "e" the samples shall be placed in a tray or vessel of such a character that will allow them to lie flat within, so that they may be completely immersed in their respective solutions.

Width.—To be not less than fifty-four (54) nor more than. fifty-six (56) inches wide independent of selvages.

Weave.—To be a four harness, two-up and two-down weave, as is the sealed standard sample.

Threads.—Warp to contain not less than 3,780 ends of single spun (combed) warp twist yarn.

Filling.—To contain not less than sixty-two picks of single worsted spun yarn per inch. Should an occasional piece (not more than one in ten of each delivery) be found to meet specification requirements in all other respects, but to count not lower than fifty-nine picks, it shall be acceptable.

Weight.—To weigh not less than sixteen ounces per linear yard. Pieces weighing less than sixteen ounces per linear yard shall be rejected, unless when subjected to a conditioned or dry-fiber test, the weight thus found with 11 per cent added (for normal regain of moisture allowable) will come up to over sixteen ounces. At the discretion of the contracting officer, pieces weighing sixteen ounces and over may be conditioned, and if found to weigh less than fourteen

and five-tenths ounces when the weight becomes constant in the conditioning oven, they shall be rejected.

Strength.—To be capable of sustaining a strain of sixty pounds to the inch warp-way, and fifty-five pounds to the inch filling-way. The strength test to be made on a dynamometer, great care being exercised to see that the material is placed in the jaws of the same at exactly right angles to the opposite system of threads. Should an occasional piece on delivery (not more than one in ten), practically perfect in all other respects, show not more than three pounds less breaking strain in the warp, and not more than two pounds less breaking strain in the filling, it shall be acceptable.

Finish.—To be well milled, thoroughly cleaned, free from crocking, moderately shorn, and like or equal in all respects of finish to the sealed standard sample.

Adopted October 31, 1906.

C. F. HUMPHREY,
Quartermaster-General, U. S. Army.

Note.—Samples of wool (warp and filling) in the clean state, also samples of wools after properly mixed to produce shade (warp and filling), as well as a skein of not less than 120 yards of each yarn (warp and filling) shall be delivered to the contracting officer with the first delivery of goods, and with each 5,000 yards.

By direction of the Quartermaster-General, the articles to be furnished under these specifications shall, in all points not covered by these specifications, be like and equal to the standard sample in all respects.

CHAPTER III

TESTS FOR WOOLEN MATERIALS

During the last century industrial conditions have changed materially. In the early days the cloth was manufactured in the home. There was no question of adulteration then. With the introduction of the factory system came keen competition, with the result that a piece of "all wool" cloth may be one-half or three-fourths cotton. The field of textile knowledge has grown remarkably, while the knowledge possessed by women concerning textile fabrics has decreased. The natural result has been that women have come to depend on the salesman for information concerning the material about to be purchased. Various experiences have led to the belief that the salesmen are usually honest but often most woefully ignorant. They should be more intelligent concerning the materials offered for sale; but since they are not it devolves upon the shopper to acquire the knowl-

edge which will make her competent to judge for herself.

"All wool and a yard wide" has come to be synonymous with good quality in the minds of many. That is a misconception, as a material may be "all wool and a yard and a half wide" and a poor material at the same time. The quality of the wool and the weave of the material are fully as important as the fact of its being all wool. "Pure dye" was thought by a tailor of more than ordinary intelligence to indicate purity of the fabrics. He was amazed when shown the adulteration in his "pure dye" materials. These illustrations show that these similar phrases cannot be depended upon as an indication of quality.

To judge of the firmness of the weave, hold the material up to the light. If the light shines through, it indicates a loose and open weave unable to withstand strain. The tensile strength test given below should also be used in this connection. The "feel" of the wool, to be acquired by practice, tells much in regard to quality. Notice carefully the difference in the "feel" of various qualities of blue serges. Threads should be unraveled and the length of

the separate fibers noted. Long fibers usually indicate a good quality of wool and extremely short ones indicate shoddy.

Tensile Strength.—The warp yarn in a material is always more tightly twisted and stronger than the weft or filling yarn. This is necessary because of the greater strain on the warp in wearing. In cheap materials, frequently, there is more difference than is necessary between the strength of the warp and weft yarns. This may be detected by exposing the warp and weft threads separately. When considerable difference is found it is an indication of poor wearing quality, as the weft threads will not be able to stand the strain of the warp.

To test the tensile strength, place the thumbs together and press them down hard on the material, holding the cloth tight underneath. Do the threads separate or break more easily in one direction than the other?

If the threads can be separated by the thumbs in this way, the material will not give good service if subjected to hard wear.

It is usually found economical in the end to buy good material. The extra expenditure of $.25 or $.50 a yard will amount to little in the

cost of a garment, yet it may double or treble its value. In the case of a garment which will be worn only a few times, because of the rapidly changing styles, a cheaper material may serve the purpose fully as well. The use to which the garment is to be put should always be considered when purchasing the material. If service is an important item, remember that pennies saved may mean dollars lost.

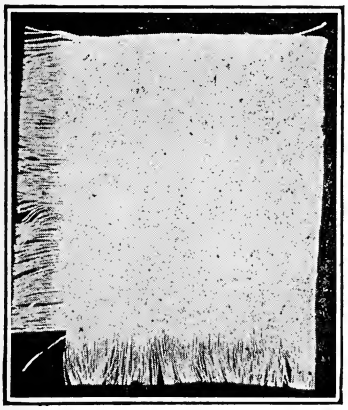
Appearance and feeling can no longer be trusted absolutely, but the trained hand and eye may do much in judging of the quality of materials. Woven fabrics made of wool should be soft when gathered up in the hand, and should spring back when the hold is loosened.

Wool should feel warm and springy. There is a great difference in the "feel" of different qualities of wool. The difference is hard to describe, but can easily be detected with practice.

Take a small piece of wool material and expose the warp and weft threads separately. After some practice the cotton can be quite readily detected unless it is covered with wool, as is often the case. Wool threads are more

curly and elastic than cotton. White wool usually has a creamy tint while cotton is dead white.

Cheap shepherd checked materials usually contain some cotton. The warp may be cotton and the weft all or part wool. Such materials clearly show the difference between the appear-



Warp and Weft Threads Exposed Separately

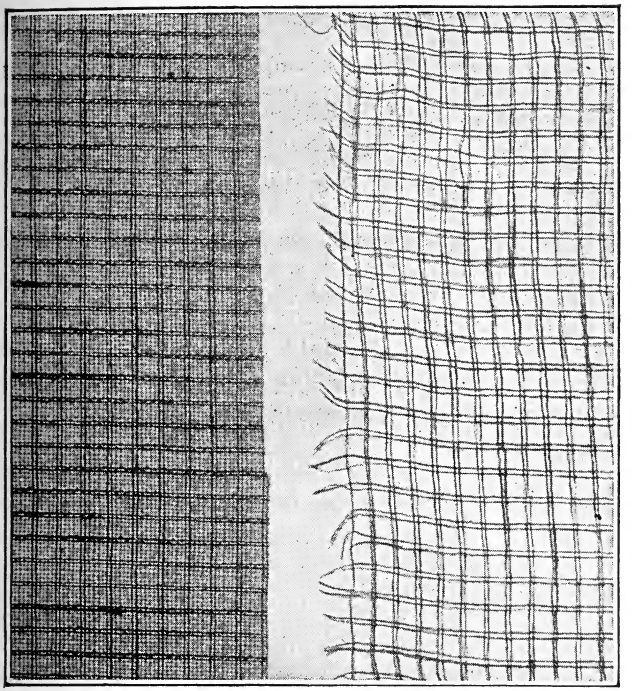
ance of wool and cotton, especially of white wool and cotton.

In a plain colored material the cotton may sometimes be detected by the difference in the way the threads have taken the dye. It is almost impossible to dye cotton and wool exactly the same color. For this reason cotton is used more often in materials of mixed colors.

Burning to Detect Cotton.—This is the most useful in determining whether certain threads are wool or cotton. If cotton and wool have been spun together, this test is not reliable, although something may be learned if the yarn is unraveled so that the fibers may be burned separately. Cotton burns quickly, leaving a small amount of ash and no perceptible odor. Wool burns slowly, leaving a black ash in the form of a ball at the edge of the flame. The odor of burning wool is that characteristic of burning bones or feathers.

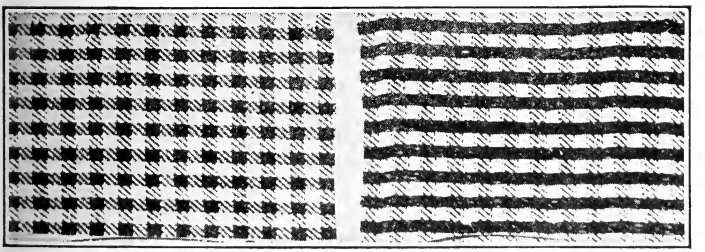
Experiment.—Select a number of materials which it is thought may contain cotton. Burn the warp and weft threads and threads of different colors separately. If a thread when burned gives off no odor of burning wool, it may be taken as a strong indication that it is all cotton. However, the odor of burning wool does not indicate that the thread is all wool.

Chemical Test for Any Mixed Cotton and Wool Fabric.—Boil a sample for 15 minutes in a 5% solution of potassium hydroxide. If it is all wool, the entire piece will be destroyed; if it is mixed with cotton, the cotton will be left and the wool destroyed. Should there be a res-



Original Residue

54 inches wide—$1.25 per yard



Original Residue

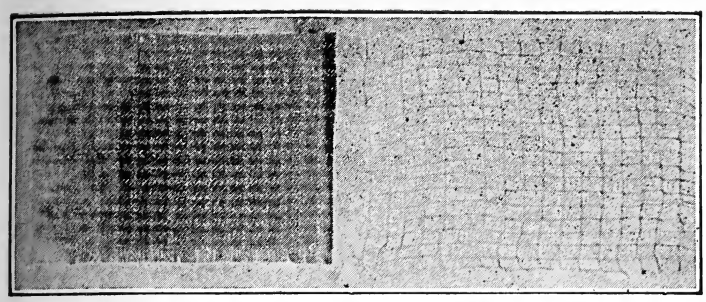
36 inches wide—50 cents per yard

MATERIALS BEFORE AND AFTER BOILING IN THE LYE SOLUTION

idue, it must be thoroughly washed, first in acidulated water (vinegar in water may be used), then in clear water and dried on blotting paper. This residue represents the cotton in the cloth. If mixed with wool in spinning, an open material will be left; if the warp is made of cotton it alone will remain. The weft will be destroyed.

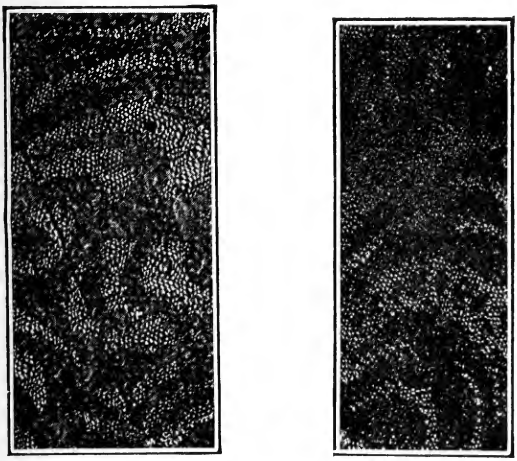
In place of the potassium hydroxide (KOH.) which is the alkali used in the laboratory, ordinary household lye may be used. From one to two level teaspoons of lye to one pint of water should be used. (The lye becomes weakened on exposure to the air.) A small sample of the cloth to be tested should be placed in a granite dish, well covered with the solution and allowed to boil gently to prevent rapid evaporation and consequently strengthening of the solution. The use of a granite dish is emphasized as the alkali will act on some metals, especially aluminum. Five minutes at the boiling point will be sufficient when using the lye as given above.

The following materials may be tested and results of the tests noted, always considering width and price of sample:



Original Residue

54 inches wide—$1.25 per yard

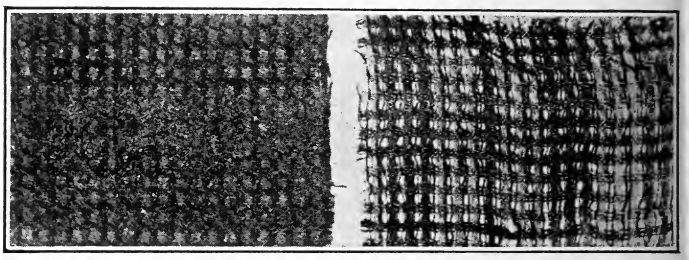


Original Residue

54 inches wide—$5 per yard

MATERIALS BEFORE AND AFTER BOILING IN THE LYE SOLUTION

2 pieces of white flannel,
2 pieces of serge,
2 pieces of shepherd check (black and white),
2 pieces of novelty goods (gray or tan mixture),
1 piece of broadcloth or a similar material,
2 pieces of any materials in which you are especially interested.



MATERIALS BEFORE AND AFTER BOILING IN THE LYE SOLUTION

It will be found helpful to study the sample before using the alkali test, and to form some judgment. After the test compare conclusions.

Test one at a time, but the same solution may be used. Add water to replace what evaporates, and if testing many at one time add some fresh solution.

The relation of cotton to wool is often plainly shown by the form in which the cotton is left.

If a piece of woven fabric remains we know that either wool was mixed with the cotton in the yarn before weaving or that wool was blown into the cloth mechanically during the felting process and finished over to give the appearance of woolen material. Cheap eiderdowns are often made in this way. Sometimes the warp is cotton and the weft wool. (A sample of shepherd check showed a cotton warp with every other check filled in by cotton weft, therefore practically one-fourth wool.)

Nitric Acid Test. (*Note.*—This test may only be used to advantage on white material.) Separately expose the warp and weft threads of a small piece of material. Dip in nitric acid and then rinse thoroughly in running water. Wool assumes a yellow color, while cotton remains white. The yellow color is due to the formation of xanthoproteic acid. If entire cotton threads have been used, this test shows them up very readily.

A piece of cheap white eiderdown treated in this way showed a few wool fibers on the surface, while the body of the material and much of the surface remained white.

A high power microscope affords a very sim-

ple method of distinguishing between wool and cotton. (Any high school doing laboratory work in zoölogy or physiology should have such microscopes.)

The following indicate the presence of shoddy:

Very short fibers,
Fibers of various colors,
Lack of uniformity in size and general character of the scales,
Structure,
Ends broken and uneven,
Scales missing on parts of the fiber.

The adulteration of a worsted cloth is more easily detected than of a woolen, as the entire thread is usually replaced by a similar one of cotton. There are pure wool cloths made of "Virgin wool" and nothing else. The great family of serges, worsted cheviots, and certain white flannels contain only fleece wool. This must be understood to refer to good quality materials demanding a fair price. It still remains a fact, however, that many fabrics used for clothing contain other materials than wool fresh from the sheep shearer, in many cases without

detriment and in some cases with positive advantage.

If the shoddy is of fairly good quality, and especially if mixed with some good new wool, the resulting fabric may look very well and give good service.

For a garment which must be laundered frequently the addition of some cotton will help to prevent shrinkage and perhaps add usefulness to the garment. If it is represented as being part cotton and sold for a reasonable price, no objection can be raised.

Several pieces of imported Viyella flannel, sold as all wool and non-shrinkable, when tested were found to contain 50 per cent of cotton. The cotton made it fairly non-shrinkable, as advertised, and increased its value for men's shirts and ladies' shirtwaists, but it was deceptive and $.75 a yard was too much to pay for a material 30 inches wide containing so much cotton. The same could be said of the only piece of so-called "all wool" white flannel, suitable for infants' clothes, which was to be had in a high class store. We are not objecting, therefore, to the use of cotton, but to paying wool

prices for cotton, and to being sold half cotton as all wool.

Tests for Fastness to Dyes, Crocking, and Fading.—A simple and practical test for crocking is to rub the material with a soft white cloth which has been slightly moistened. If any color comes off on the white cloth, the material will crock.

To test fastness to light, the sample to be tested is placed in a suitable frame in such a manner that only a part is exposed. The frame is then placed in such a position that it receives as strong sunlight as possible. A window with southern exposure is a good location in which to hang the frame containing the samples. At the end of one week's exposure the samples are examined, and note is made of those which show any appreciable fading. These are to be classified as not fast. At the end of the second week another examination is made and those samples noted which show an appreciable fading. These are to be classified as fairly fast. At the end of four weeks the samples are once more examined, and the colors fading in this period are noted and classified as fast. The samples

which show no fading at the end of four weeks are classified as very fast.

The samples may be partly covered with black paper, fastened securely to a piece of wood, and exposed to the light as suggested above.

Test eight samples, varying in color and price, for crocking and fastness to light.

CHAPTER IV

SILK

The silk industry is supposed to have originated in China about 2,700 B. C., the art being known only to the royal family for a long time. But gradually the knowledge spread and it soon became an important industry in China. Later it became known to the people of Japan, and slowly it spread through Central Asia, Persia, Arabia, Spain, Sicily, and along the African coast. Silk culture was practiced in Italy in the 12th century, and in France the following century. Most of the silk of commerce is obtained from the cocoons of a certain kind of caterpillar called "Bombyx mori," or mulberry silkworm which feeds (as the name implies) upon leaves of the mulberry tree. There are other varieties of silkworm which cannot be cultivated; these are called wild silkworms. They produce an inferior grade of silk called "tussah." From this wild silk is manufactured the pongee silks

of commerce. Most of the raw silk on the market is produced in China, Japan, France, and Italy.

Throughout the succession of changes which take place in the insect, the greatest care has

Silkworm Culture

to be exercised in regard to temperature, quiet, and food. After the moth lays the eggs they are collected and kept cool until time for incubation, which process takes place in heated compartments where the temperature is carefully regulated. The period of incubation lasts about thirty days and then the worms hatch out as

tiny little things no larger than the head of a pin. The growth and development of the worm proceeds rapidly. Its food is chopped mulberry leaves. There are four molting stages, at each of which the worm sheds his old skin, and emerges with a new one. This is caused by the body growing faster than the skin. At the molting time the worm ceases eating and remains in a torpid state for a couple of days, rests a short time to regain strength, and then begins eating with renewed vigor. After the fourth and last molt the worm is 1¼ inches long, but, in the few days remaining before it spins its cocoon, it grows to 3 inches in length. As soon as it has attained its full growth, which seldom exceeds 3 inches, it is ready to spin its cocoon. It stops eating, shrinks nearly an inch in length, loses in weight, turns pale in color, and seeks a place to which it can attach the cocoon. The web which it forms is composed of a secretion exuded from two glands in the body, which unite into one common exit tube below the mouth, where also exudes another secretion which cements the two threads together. The double silk fiber is called "fibroin," and the silk glue is called "sericin." This gum which

cements the fibers together hardens upon contact with the air.

The worm forces the silk fiber out by contracting his body, turning his head from side to side and throwing the fiber around himself in figure eight loops, until layer after layer, the cocoon is gradually completed—a process which requires about three days. The cocoon is ovoid in shape and is composed of one continuous thread which is 400 to 1300 yards long. After the cocoon is finished the worm passes from the form of a caterpillar into a chrysalis, from which it rapidly develops into a moth. Unless the chrysalis is killed before the moth has developed, the cocoon will be pierced and the thread broken, so live steam is applied, which kills the chrysalis, and the silk can then be reeled off at any time.

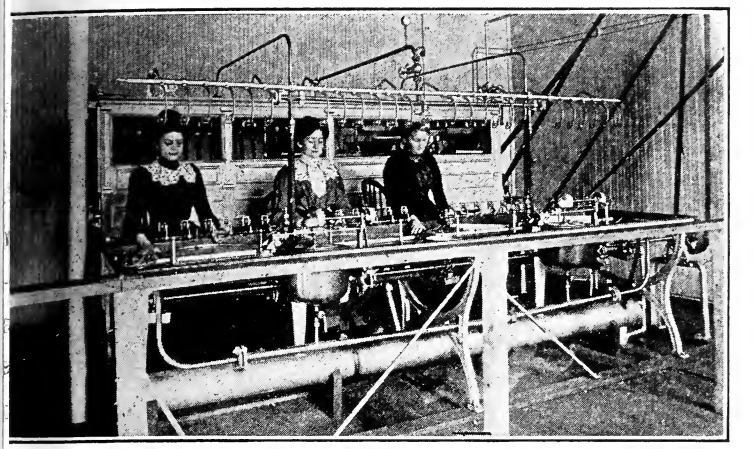
The life cycle lasts about 55 days on the average: (a) 30 to 40 days as larva; (b) 15 to 20 days as chrysalis; (c) 6 to 12 days as moth. A moth lays about 700 eggs in three days, 30,000 eggs equalling 1 oz.

Silk Reeling.—Silk reeling is accomplished by soaking the cocoons in warm water to soften the gum and then carefully unwinding the fibers,

twisting several together, according to the size of thread desired, and winding it into skeins. These skeins are put into canvas bags and soaked over night in warm soapsuds to further soften the gum which has stuck the fibers together. Then they are hung across poles in a steam heated room and dried. Following this the silk is wound upon bobbins and spun into thread.

The waste silk from the reeling is mixed with that from the outer part of the cocoons, known as "floss," and is subsequently spun into what is called spun silk. It is treated as a bundle of fine fibers, like wool or cotton, and is spun by textile machinery that is especially adapted to it.

Silk Dyeing.—Silk is dyed either in the yarn or in the piece. If dyed in the yarn, the gum is removed by soaking in boiling soap and water, then the yarn is washed in cold water. At this point weighting is often put in—tin, iron, or other mineral salts being absorbed by the fiber. Sometimes there is more weighting than silk, for silk has the peculiar property of being able to absorb certain minerals. Because of this they are much used to deceive the buyer into paying a



Reel in Operation

Reeled and Waste Silk

higher price for silk than it is worth, as weighting makes silk both weak and tender, and inferior grades are apt to be used. Silk will take up 50 to 200% of weighting without arousing much suspicion. The silk is dyed, the luster restored, and it is then ready for weaving, after which the material is singed to remove loose fibers, straightened, and sized with starch or glue to stiffen it.

Since 1624 several attempts have been made to rear silkworms in America. All have met with failure because of climatic or labor conditions. In some cases the mulberry trees were injured by early frosts and in all cases the low cost of labor in Europe offered a competition that it has been impossible to meet. It is interesting to note that the original Cheney Bros., well-known silk manufacturers, made an attempt to raise silkworms in South Manchester, Conn. Some of the mulberry trees, planted at that time, are still standing. Importing the raw material and manufacturing it in the United States has been found to be the best business proposition. There are about 700 establishments for the manufacture of silk in the United States. Paterson, N. J., is the silk city of Amer-

ica, having more than 300 mills and employing 40,000 men and women. The manufactured silk that is imported now is confined to the costliest fabrics in broad silks, to fashionable novelties, and to church vestments and specialties not suitable for mechanical weaving.

The following is a table from "Shelter & Clothing" by Kinne & Cooley:

COMMON SILK MATERIALS

Name	Usual Width	Usual Price	Description
Bengaline.....	18 to 22 in.	$.75	Used for dress goods and trimmings. Effect of rounded silk cord like poplin. Made in all silk or with wool cord of woof covered with silk warp.
Brocaded Satin..	24 in.	$1 up	Beautiful fabrics of Jacquard design. Slightly raised from surface. Dress goods, trimmings, and furniture coverings.
Chiffon.....	46 in.	$.75 to $2	Used for dress goods, veils, millinery, and trimmings. A thin, gauzy, light fabric of plain colors generally. Finished soft or with dressing.
China Silk.....	24 in.	$1	Name used for plain handwoven silks of plain

Name	Usual Width	Usual Price	Description
			weave in China. Distinguished by irregular threads and softness. Used for waists, dresses, underwear. Very durable.
Crepe de Chine..	22 in.	$.75 up	Used for dress goods. Plain color or printed. Smoother surface than most crepes. Soft and lustrous. Plain weave. Effect produced by right and left twisting of warp threads.
Foulard.....	24 in.	$.75 up	Dress goods of printed or woven design. Name in French, "handkerchief," for which originally used.
Habutai.....	27 in.	$.60 to $2	Woven in gum. Boiled and finished after weaving.
Moiré.....	22 in.	$2	A watered effect produced by pressing between stamped rollers on grosgrain silk. Used for dresses and trimmings.
Louisine.....	20 in.	$.85 to $1.50	A plain, durable silk, soft, glossy texture, slightly twilled in effect. Used for dress goods and trimmings.
Maline.....	27 in.	$.25 to $.50	A soft, thin, gauzy fabric. Similar to net.
Mousseline de Soie	45 in.	$.50 up	A thin, gauzy fabric with more starch in finish than soft chiffon. Used

Name	Usual Width	Usual Price	Description
			for trimmings and dress goods.
Peau de Soie....	21 in.	$.75 to $1.50	A plain, colored, reversible silk in good quality. A heavy, soft-finished silk. Used for dress goods and trimmings.
Pongee.....	27 in.	$1 up	A soft, unbleached, washable silk, ecru in color. Woven from silk of wild silkworm. Originated in China. Hand woven. Used for dress goods, coats, etc.
Plush.....	24 in.	$3	A long, shaggy fabric of velvet class. Woven and pile cut. Used for dress trimming, furniture covering, draperies, etc.
Rajah.....	36 to 54 in.	$.60 to $2	A rough silk, plain weave of irregular threads. Not very durable. Used for dresses and coats.
Satin.....	21 to 54 in.	$1 to $10	A very old weave with much of woof on surface to give smooth finish. Made in all grades and combined with linen and cotton. Used for many purposes, box making, fans. Better qualities for fine gowns.
Skinner's Satin..	36 in.	$1.25	Used for lining.
Taffeta.....	21 in. up	$.60 to $2	A thin, glossy silk of plain texture. Same on both sides. Plain col-

Name	Usual Width	Usual Price	Description
			ors. Made also with printed and woven figures. Used for gowns, petticoats, linings. Does not wear well unless good quality and small per cent of weighting.
Tulle.....	3 yd. wide	$.75 to $2.25	A kind of silk net of open mesh. Used for neckwear, veiling, etc.
Velvet.....	18 to 42 in.	$4 to $20	Used for handsome gowns and trimmings. Woven and cut to form pile. Made also of cotton or linen in combination.

Physical and Chemical Characteristics of Silk Fiber

Physical.—Under the microscope the silk fiber appears as a smooth, structureless filament, regular in diameter and transparent. One striking characteristic of silk is its high luster, which, however, only appears after the silk has been scoured to remove the silk gum. Dyeing and mordanting also affect the luster more or less, especially when silk is heavily weighted,

and, therefore, after dyeing, silk usually goes through a lustering operation in which the hanks are stretched strongly by twisting and at the same time steaming under pressure. By this process much of the luster is restored.

Raw silk will absorb as much as 30% of its weight in moisture and still appear dry. This property is called hygroscopicity, and because of it the amount of moisture in the silk has to be determined at the time of sale and allowances have to be made for it. The amount legally permitted is 11%.

Another property of silk is that of being a poor conductor of electricity. It is, therefore, readily electrified by friction. Silk is the strongest fiber known, said to almost equal the tensile strength of iron wire of equal diameter. It is also extremely elastic, raw silk stretching from 15% to 20% its original length in the dry state before breaking. Weighting of silk causes a decrease in both elasticity and strength.

A property which is peculiar in silk is its "scroop"—the crackling sound it makes when rubbed or squeezed. This is the cause of the rustle which characterizes most silk materials,

although weave influences the degree to a large extent.

Chemical.—As has been mentioned before, the silkworm has two sets of glands, one of which secretes the fibroin or silk fiber, and the other set secretes the sericin or silk glue which coats the fibers and cements them together. Fibroin composes about ½ to ⅔ of the silk secretion, the rest being composed of the sericin. As soon as the two fibroin fluids come into contact with the air they solidify, and coming into contact with each other at the moment of discharge, they are coated with the silk glue and firmly cemented together. The sericin is yellow in color and is soluble in hot water, hot soap, and alkaline solution. The silk is worked in a soap solution at a temperature of 203° F., losing from 20% to 30% in weight and becoming soft and glossy. In regard to many of its chemical reactions silk is similar to wool. It can stand a high temperature, 230° F., without decomposition. It readily absorbs dilute acids, and has a strong affinity for tannic acid, which fact is used in dyeing and mordanting. It readily absorbs sugar, which is sometimes utilized in weighting light colored silks. Silk also has such

an affinity for ordinary metallic salts that it is often heavily weighted with them. Common salt, however, destroys the silk fiber. That rotting of silks due to the salt present in perspiration is frequently noted.

Concentrated acids and strong, hot alkalies destroy silk, and dilute alkalies decrease the lusters, although they have less effect on the strength of the fiber than upon wool.

Silk has a great affinity for dyestuffs, absorbing coloring matter readily. Authorities disagree as to whether this is a physical or chemical process, or a combination of the two.

Weighting of Silk.—The practice of weighting silk is probably centuries old, for it has long been known that silk possesses a great affinity for tannin, but it is only within the last 25 years that weighting has been in general use.

The boiling off of the gum reduces the weight of the raw silk from 5 to 30 per cent. Since the price of raw silk is about $5 per pound it is not to be wondered at that ways have been devised to make up this loss. Harmless additions of plain sugar and sugar of lead were used in the beginning but the demand for cheap silks has brought about an exaggerated and injurious

weighting. The throwster may leave an excess of soap and oils in the silk but most of the loss is made up and weight added in the dyeing process. Silk is very absorptive, it being possible to weight or load it up to five times its boiled off weight. While this is a great advantage to the manufacturer, it is unfortunate for the consumer, since the result is the mechanical weakening of the filaments. This may be explained in various ways: first, the stretching of the walls when taking in the metallic weighting weakens the fibers; second, the salts crystallize when exposed to the sunlight, thus cutting the delicate filaments; third, oxidation occurs in the course of time, with a consequent weakening of the fibers; fourth, perspiration causes deterioration because chlorine is freed, which causes rotting.

The silk to be weighted is immersed in a series of solutions, with thorough washings between each treatment. The number of immersions is determined by the amount of weighting desired. To weight a silk heavily requires many dippings. Compounds of tin, lead, and iron in solution are most commonly used. White and light colored silks are weighted as

well as black and dark colored. This is contrary to the opinion commonly held, but can be easily demonstrated. Weighting reduces the strength of the fiber greatly. Strehlenart showed a black silk weighted to the extent of 140 per cent was only one-sixth as strong as pure crude silk. Even a weak solution of common salt has a pronounced deteriorating effect upon silk that has been weighted with metallic compounds. The salt in the perspiration undoubtedly accounts partially for its disintegrating effect upon silk. The action of sea water also illustrates the effect of a salt solution on weighted silk.

The practice of weighting silks with metallic salts is responsible for the small holes which frequently appear in present day silks. It also accounts for the splitting which is so common, as well as the fact that it is difficult to find a silk today which has satisfactory wearing qualities. The silkworm has not lost the art of spinning good silk, but the manufacturer has taken advantage of this peculiar quality of silk. While this has made it possible to sell silk fabrics at a much lower price than formerly, it has also produced a condition where it is almost impossi-

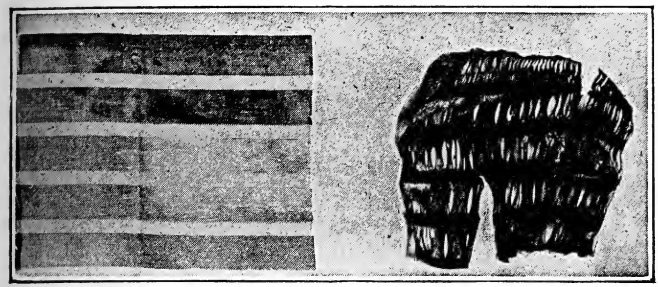
ble to find a silk of the firm taffeta type, at any price, which is free from weighting.

Again, what we need is textile laws requiring proper labelling of material offered for sale. To quote from an article in *Harper's Weekly:* "There is at present an agitation in the silk trade to bring about the marking of all silk to show its degree of purity, so that the innocent consumer may be able to buy silk with some degree of intelligence. It is pointed out that, while there are conditions when the adulteration is not harmful (when the wear is not essential) a law of this kind would greatly increase the standard of quality."

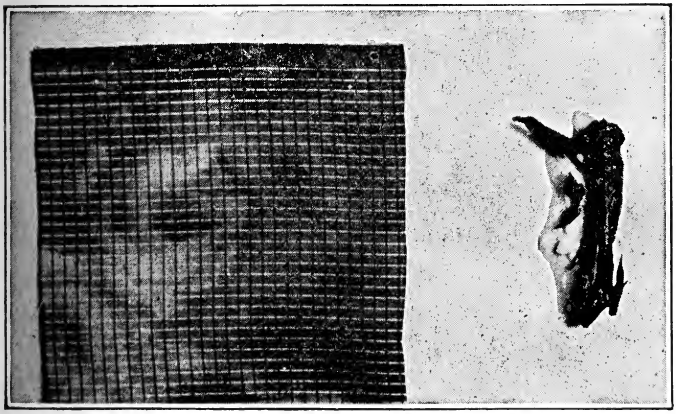
We will not attempt to decide whether the public or the manufacturer is most to blame for the present condition. However that may be, it should be possible to purchase well-wearing silks, if one is willing to pay the price.

The simplest test for the detection of weighting in silk is that of burning the fiber. Pure silk, when held in a flame, burns quickly, melts, and runs together, leaving a small quantity of carbon. If burned long enough at a sufficiently high temperature this residue entirely disappears.

Weighted silk, when burned, simply blackens and remains in practically the original form. A longer burning would again decompose the



Original Residue

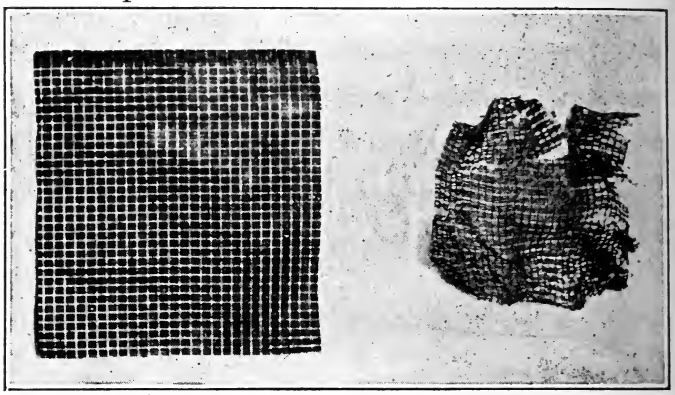


Original Residue

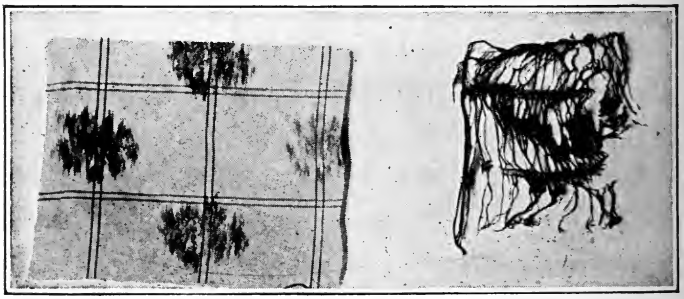
Weighted Silk Above, Pure Silk Below, Before and After Burning

black carbon but still leave the mineral matter, usually in the form of a grayish or reddish ash, depending on the mineral used.

Sometimes the threads one way will be weighted while the others are pure, and less often a piece will be found which has a few



Original Residue



Original Residue

Weighted Silks Before and After Burning

weighted threads woven in a design, while the bulk of the material is pure silk.

The simple burning with a match is a most practical household test. As a general rule,

the less weighting the greater service may be expected from the material. Where the threads one way are weighted, this rule does not hold

Original Residue
Messaline, 21 inches
$1.50 per yard

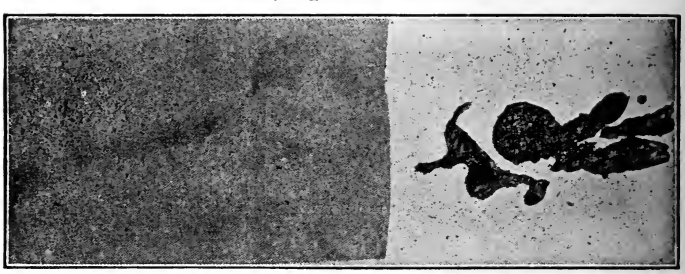
WEIGHTED SILKS BEFORE AND AFTER BURNING

good, because if the threads in one direction give way, the material loses its usefulness.

Burn a number of pieces of silk to discover some which are pure silk, some weighted both ways, some weighted only one way, and if possible some which show weighted threads used in

a design when the large part is pure silk or vice versa.

Wash silks are often part cotton. Perhaps the most common mixture is a cotton warp and silk weft. By exposing the warp and weft threads separately the difference can often be detected readily. The following test may be used if there is any question.



Before After

Charmeuse Messaline

PURE SILKS BEFORE AND AFTER BURNING

Treat a sample with concentrated hydrochloric acid (HCl). Silk will dissolve much more quickly than any other fiber.

Other silks have been found to be adulterated with linen, also. This is not common, and may be detected by using the same test and the microscope.

Artificial Silks.—The idea of producing fine threads having the luster of natural silk dates

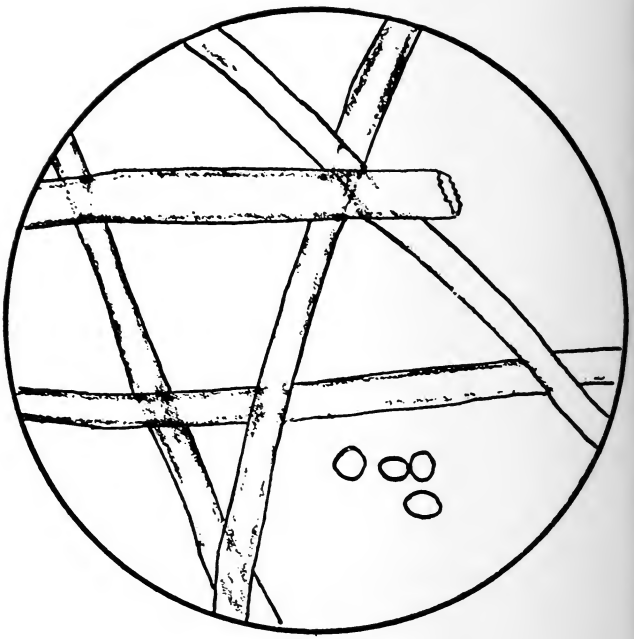
back as far as 1734 when the French naturalist Réaumur suggested that since silk was what he described as a naturally hardened gum, it should be possible to produce similar filaments by forcing a varnish, such as that used by the Chinese, through minute openings, and drying the threads thus obtained.

In 1855 Andemars of Stockholm took out a patent in which nitrated cellulose, prepared from the inner bark of the mulberry tree, was dissolved in a mixture of alcohol and ether and the solution evaporated with a solution of India rubber. A steel point was dipped into the viscid liquid, and the threads adhering to it were drawn out into fine filaments. This did not achieve commercial success.

Real beginning was due to Chardonnet whose first patent was obtained in 1885. Nitrocellulose, prepared from cotton or wood pulp, is dissolved under pressure in a mixture of ether and alcohol, and the viscous solution forced through small openings 1/100 mm. in diameter. The solvent evaporates and leaves the nitrated cellulose. Three, four, or more fibers are spun together, and the threads denitrated by immersion in a 5% to 20% solution of ammonium

hydrosulfide, and finally washed, dried, and dyed to any color desired.

Artificial silks are made on a commercial scale by the Chardonnet process in France, Ger-



CHARDONNET SILK FIBERS

many, and Belgium, and on a smaller scale in England and the United States. Their use is limited almost entirely to ribbons, braids, tapestry, and other fabrics in which strength is not the primary consideration. Compared with

true silk, the artificial silks feel harsher to the touch, are even more brilliant and lack the strength and elasticity of the natural product.

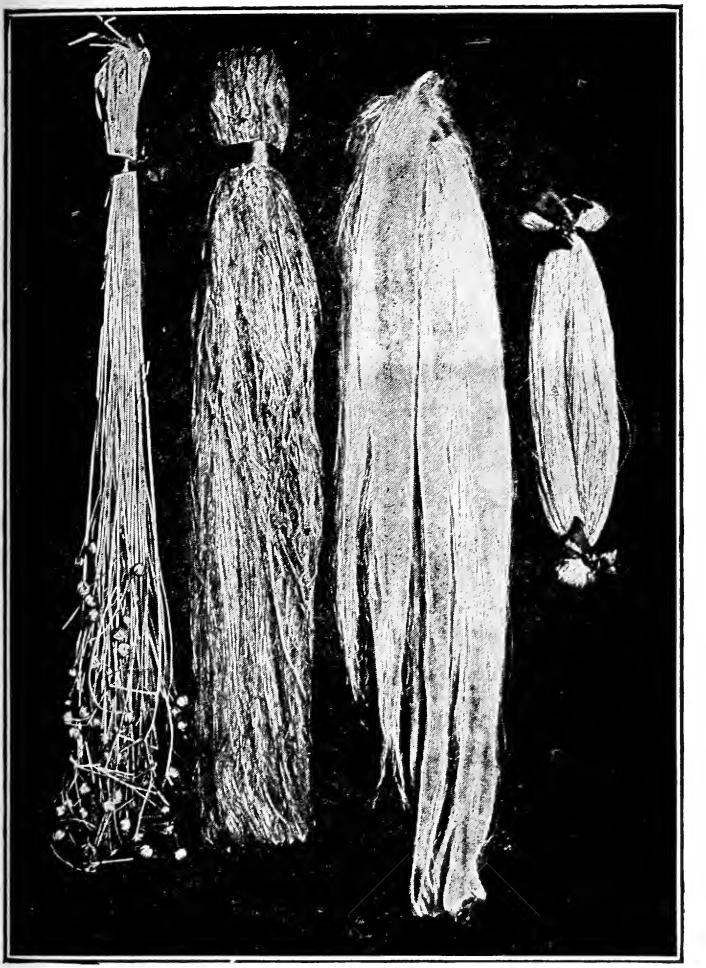
The chief drawback to the commercial success of collodion silk is its behavior with water. When wetted, the fiber loses its original strength to such a degree that it must be handled with great care. Soap solutions and dilute acids have no injurious effects, but alkaline solutions rapidly disintegrate the fiber and finally dissolve it completely.

CHAPTER V

LINEN

It is difficult to tell just when or where linen was first used, but most historians agree that Egypt probably first discovered the value of the flax plant as a source of linen. The earliest picture writings show that the linen industry was well developed. Genesis 41:42 tells us that Pharaoh arrayed Joseph in vestures of fine linen, and there are other references to flax in Egypt. This was about 1715 B. C. The reference to "fine linen" would indicate that the industry had reached a high state of development. Mummy cloths 4,000 years old show linen of quite a fine quality.

From Egypt linen culture spread to Babylon, to Greece, and to Rome. Great encouragement was given to it in Italy, and guilds were later formed to regulate and protect the linen trade. All over Europe during the Middle Ages, and until the invention of power spinning, linen was



Flax in Different Stages of its Preparation for Weaving

used almost entirely where today cotton is used. Since the industrial revolution, cotton has replaced linen for many purposes. It can never replace linen for table service and many other purposes, because it lacks luster, smoothness, and the excellent laundering qualities.

Ireland, Belgium, Holland, Germany, Russia, France, parts of the United States, and Canada are raising large quantities of flax at the present time. Russia produces more than half of the world's supply, but Ireland and Belgium rank first in quality.

Flax culture must be divided into two branches: culture for fiber, and culture for seed. In the United States flax is raised almost entirely for the seed. The relatively small amount of flax manufactured is imported and used largely for coarse fabrics, twine, and thread.

The flax plant requires a temperate climate and a rich soil if it is to be used for fiber, as the growth must be rapid. An even, moist temperature and low altitude produce the best grades of fiber.

The seed is sown early in May, and it is grown and ready to pull by the last of June. The plant grows from a foot and a half to three

feet in height and bears a delicate blue flower. Before the seed is entirely ripe, and when the stalk of the plant has turned yellow about two-thirds of the way down, the flax is harvested. It is pulled instead of being cut, to save all of the available fiber.

Linen is the bast fiber of the flax plant, and to separate it from the rest of the plant is a long and tedious process. The following is the general method of procedure: (1) rippling, (2) retting, (3) drying, (4) braking, (5) scutching, (6) hackling. Rippling removes seeds and leaves by crushing between rollers. Retting is a process of fermentation which loosens the bast fibers from the woody portion by decomposing the resins which unite them. This is accomplished in one of three ways: (1) by exposing it to the dew, (2) by allowing the fibers to remain in stagnant water for several days, or (3) by leaving them in slow running water. This last method probably gives the best results. The most successful attempt to shorten the process is by the use of tanks of heated water. In this way the retting may be accomplished in from fifty to sixty hours. After retting, the bundles are set up in the fields and allowed to dry.

Braking crushes the woody part in a flax brake as a preparatory step to separating it from the fiber. Scutching separates the straw and fiber by the action of several wooden knives, mounted in a wheel, which strike, as the wheel revolves, against a wooden block across which the flax is laid. Hackling combs out the fiber, freeing it from the woody portion, and dividing the fiber into "line" and "tow"—"line" being the long, smooth fibers, and "tow" being the short, snarled ends used only in cheap linens. Hand hackling usually takes the place of the machine for the better grades of flax. Drawing and spinning are similar to the process as used in the manufacture of cotton. Flax spinning is much more satisfactory if done in a moist atmosphere. The hand spinner of former days kept a bowl of water at hand, in which she moistened her fingers as she spun.

Weaving linen is rather more difficult than weaving cotton. The fiber is not so elastic, and breaks when there is a sudden strain instead of stretching as cotton does. Coarser linens, such as Russian crashes, are still woven on hand looms by peasants in different countries. Fine damask, woven for so long on hand looms, is

now made almost entirely on power machines.

Bleaching may be done at one or two different times: (1) immediately after retting, or (2) after the cloth is woven. If it be done most carefully it requires a combination of many washings, treatments with bleaching powder, rinsings, grass-bleaching processes requiring not only weeks of time, but proper fields upon which the cloth may be spread and favorable weather to do the grassing. The modern process in the United States is accomplished almost entirely by chemicals. It is treated with sodium carbonate, bleaching powder, and dilute sulphuric acid successively, being thoroughly washed between these operations. Ireland, famous for its beautiful linens, uses the first method.

Linen loses from 25 to 30 per cent in bleaching, and becomes weaker as it becomes whiter. The loss of tensile strength is much more marked when chemicals are largely used than when the natural agents—sun and air—do the work. This partially explains the great difference in wearing quality between the old homespun and the modern machine-made linens. After bleaching, the material is washed, dried,

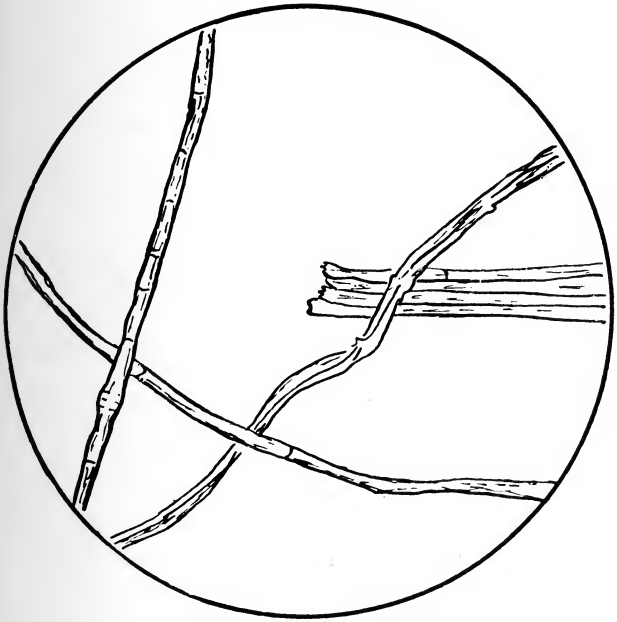
starched, and ironed to give it a glossy appearance. The heavy pressing after the addition of sizing materials not only gives a good finish but also makes it possible to handle the linen in the store without destroying its finished appearance. Sizing, when added in excess, makes a poor grade of cloth look well, but after washing, the material often disappoints the buyer.

Physical and Chemical Characteristics of Linen Fiber.—Good flax fiber, when separated from the stalk, should be from 12 to 20 inches in length, and will vary greatly in fineness. It is stronger than cotton, but lacks elasticity. Under the microscope the flax fiber is seen to be a long cylindrical tube with transverse markings or nodes at more or less regular intervals. The fiber is composed of cells consisting almost entirely of pure cellulose. The color varies from yellowish-white to brown, and from pearl to steel gray, the best quality being pale yellowish-white. The variation in color is due largely to differences in the process of retting.

The hygroscopicity of linen is low, varying from 5 to 8 per cent, but the absorptive power is unusually high. It is this quality which makes

linen an especially valuable material for towels.

Luster is one of the most prized assets of linen, and is retained as long as the fiber lasts. The process of retting may affect the strength



Flax Fibers

and luster to some extent if allowed to continue after the resins are dissolved.

Compared with the other textile fibers linen is the best conductor of heat and electricity. It

is this property which makes linen feel cool to the touch.

Toward mordants and dyestuffs linen does not react so readily as cotton; therefore, it is more difficult to set dye in linen cloth.

The action of acids and alkalies upon linen is much the same as upon cotton, strong mineral acids destroying the fiber, cold dilute mineral acids affecting the cloth but little if thoroughly washed out, and organic acids having no effect unless allowed to dry on and are afterwards moistened and ironed. Alkalies, if caustic, destroy linen cloth the same as cotton, but dilute washing soda solutions, borax, and soap have no appreciable effect on linen. The same precautions have to be taken in using bleaching powders as with cotton cloth.

Common Linen Fabrics

Crash.—A heavy, loosely woven material made of coarse yarn. It is much used for toweling and summer suitings.

Damask.—A lustrous, satiny material used for table linens.

Art Linen.—A material having a round, hard twisted thread. It is much used for embroidering and drawnwork.

Handkerchief Linen.—A sheer, fine linen used for handkerchiefs, infant's dresses, waists, and women's clothes.

Huckaback.—A dice-like pattern, very heavy and serviceable, used for toweling.

Butcher's Linen.—Coarse, white material used for linings mainly.

Glass Toweling.—A smooth finished checked toweling made in Ireland.

Household Linens.—Because of its smoothness of texture, its brilliancy, and its excellent wearing and laundering possibilities, linen is the one fiber best suited for the table and toilet. The very fact that it does not take dyes easily makes it easier to remove stains from linen than from cotton, and the satin smoothness of the cloth keeps it clean longer than other material.

Table Linen.—Ireland, Scotland, and Germany supply most of the table linens. Irish linens are the best and most expensive, running from $.75 or $1 a yard to $3. The John Brown linen with the shamrock trade-mark, is one of the well-known brands of dependable quality. The Scotch linens have excellent patterns and run from $.50 to $2 and over for a yard. German damask, which is very durable owing to its having a closer, harder twisted thread than the

others, runs from $.50 to $1.50 a yard. French damask is noted for its exquisite designs and effective appearance; the thread is fine and round. There is a wide range in quality, from the most expensive to the cheaper grades.

When buying linens, rub them between the fingers to remove the starch and choose those which are firm and heavy with not too fine a thread. A consideration of the pattern is not only important from the standpoint of design but of wearing quality as well. A large figure with long overshot threads will not wear so well as the one with a smaller design and shorter threads on the surface. The reason for this is obvious, but is often forgotten when purchasing table linen.

Bed Linen.—Although most attractive in appearance and most durable, linen is not the most satisfactory material to use for sheets and pillowcases, as it is so easily wrinkled and, furthermore, feels damp and chill when brought in contact with the body. The high price of linen is also a point against its common use in this way. Linen sheeting ranges in price from $1.50 to $2.50 a yard. Hemstitched linen sheets may be purchased for about $7.50 a pair. The

tubing for pillowcases ranges in price from $1 to $1.25 a yard, and the ready-made pillow cases from $1.25 to $2 a pair.

Toweling.—The quality of easily absorbing moisture, which is a characteristic of linen, makes it suitable for use as towels. The checked glass toweling is excellent for drying silver and glassware, while for heavier dishes medium weight crash will give satisfaction.

Hand towels of Irish huckaback give the best satisfaction, being fine and soft and yet firmly woven. The familiar cotton Turkish towel is now duplicated in linen which, after one or two launderings to remove the harshness, is a delight to use.

Because linen brings a much higher price than cotton, and because cotton may be finished to resemble linen, dishonest dealers frequently deceive the buyer into paying for a product which he does not receive. Sometimes the two fibers are mixed, and again cotton alone is heavily starched and given a linen finish which is hard to distinguish from the true fiber.

Distinguishing Between Cotton and Linen

(Wash materials to remove the dressing before applying the following tests.)

1. Linen feels smooth, cool, and heavy compared with cotton. Linen also takes greater luster in ironing.
2. Untwist a cotton and a linen yarn. Pull them apart slowly and steadily. The ends of cotton fibers curl; linen fibers remain stretched and pointed.
3. Tear the material and compare the edges. The torn edge of linen is more irregular than that of cotton.
4. Apply glycerine or oil, cotton remains opaque and linen becomes translucent.
5. Burn some of the material. The burnt end of cotton is tufted, and that of linen is rounded.
6. Ink dropped on linen is quickly absorbed and makes a spot with a regular outline, while on cotton the absorption is slower and the spot has a much more irregular outline. Often ink will be drawn out along the separate cotton fibers for some distance. This is due to a difference in the capillary attraction of the two fibers. This test involves somewhat the same principle as the old test of moistening the finger and putting it under the material, but is much more satisfactory.

Note.—No one of the above should be taken as absolute. Try several before making a final decision. Manufacturers have become so clever that they are

able to treat cotton so as to make it look and react very much like linen.

Select the following set of samples and test as suggested above:

3 samples of table linen—varying in price,
3 samples of huck toweling—varying in price,
2 samples of heavy linen—suitable for tailored suits,
1 sample of handkerchief linen,
1 sample of linen sheeting,
2 samples of glass toweling,
2 samples of crash.

CHAPTER VI

LAUNDRY PROBLEMS

Someone has said that "The state of civilization may be judged by the soap bill of the nation." That there is some truth in the statement we will all admit, I am sure. During the past decade there has been awakened a new interest in the subject of laundering which is a hopeful sign.

We may differ, in our judgment, as to whether ironing is a necessity or a luxury, but there would be no disagreement as to the necessity for washing.

It is not simply to satisfy our sense of the aesthetic that the periodic washing has become an established custom in the home. There is a sanitary reason which a few words of explanation may help us to understand more fully.

The skin acts as a heat regulating apparatus through evaporation of the perspiration, and also serves in some measure to eliminate the

body's waste products. These materials are absorbed by the clothing, and after a time the pores of the cloth become clogged. This condition prevents proper absorption and evaporation of moisture from the body, thus increasing warmth of body in summer and making it colder in winter.

The following may be given as the three main reasons for washing:

1. To remove dirt and to open the pores of the cloth,
2. To dry the cloth and to renew its absorbing power,
3. To destroy any bacteria present.

In order that we may understand laundry methods it is necessary first to learn something of the nature of the things to be laundered and how these respond to the cleansing agents commonly used. The purpose is not to discuss methods so much as the underlying principles which, if understood, will aid in the choice of the best method.

We have learned by experience that cotton, wool, and silk must be treated differently if the best results are to be obtained. It may be of

interest, therefore, to determine why this is true. In the previous chapters the physical and chemical properties of the various fibers have been given, but will be repeated briefly to make the application a little more evident.

The vegetable fibers, cotton and linen, are most frequently laundered and, therefore, deserve first place in this discussion. Their cellulose composition being so nearly the same, we find the behavior toward acids and alkalies, the chemicals we are most concerned with in the laundry problems, so nearly identical that they may be considered together. Effect of acids on the vegetable fibers:

1. Strong mineral acids, as sulphuric, nitric, and hydrochloric, entirely destroy the fiber in a very short time.
2. Cold dilute mineral acids have little effect if not allowed to dry on. Organic acids, as acetic in vinegar, oxalic in tomatoes, citric in lemons, etc., have no action unless allowed to dry on. If dried, moistened, and ironed, they will destroy the fibers.

Effect of Alkalies on the Vegetable Fibers:

1. A strong solution for a short time increases the strength, as is illustrated in the process of mercerization. If submitted to the treatment for a longer time the fiber is weakened.
2. Dilute alkalies have little, if any, effect according to present data. As many of the washing compounds, if properly used, come under the above class, the fact is of great interest to the laundress. The more delicate the fiber the greater the care which is necessary in their use.

Effect of Acids on the Animal Fibers:

1. Wool: Strong mineral acids destroy wool, but the destruction is much slower than with cotton. If acid is dilute, there is practically no effect.
2. Silk: Strong acids disintegrate silk. A dilute solution weakens the silk fiber, but the action is less rapid than with cotton.

Effect of Alkalies on the Animal Fibers:

Strong alkalies, even though cold, have a softening effect on the wool or silk fibers,

entirely disintegrating them in a short time. A dilute boiling solution will also dissolve the wool. This fact is made use of in the test distinguishing wool from cotton. Dilute alkalies weaken silk and destroy the luster.

Water.—A plentiful supply of water good for laundry purposes is an important factor in successful laundering. Good drinking water and good water for the laundry may not necessarily be identical. The mineral matter held in solution may be of value in the body, but be detrimental in cleaning processes. A good water for the laundry should be clean, soft, clear, odorless, free from discoloration, free from iron, and from organic matter.

Hard and Soft Water.—Because water is a good solvent, on its way to us through the rocks and soil it often collects soluble substances of an undesirable nature. The characteristic known as hardness is due to the presence of lime salts gathered in this way. When soap is used with hard water, a scum forms on the surface which is composed of an insoluble lime soap. This has no cleansing properties, and so

simply wastes the soap which has been used. If the available supply of water is hard, the problem of the housekeeper is to find some means of removing the lime or of reducing its ill effects.

Temporary and Permanent Hardness.—According to the nature of the lime salts present, water is said to be temporarily or permanently hard. Temporary hardness is caused by the presence of carbonate of lime, and such water may be softened by boiling. The sediment present in almost any teakettle illustrates this.

Permanently hard water contains sulphate of lime and can only be softened by the use of some chemical. The cheapest and best is an alkali such as washing soda, borax, or ammonia.

Washing soda, which is most effective for ordinary use, should be used in the following proportions unless the water is extremely hard: For each gallon of water use two tablespoons of solution made by dissolving one pound of washing soda in a quart of boiling water.

Borax is especially good for colored goods and wool, and even though more expensive it may be economy to make the extra expenditure in those cases.

The only satisfactory method of getting rid of iron is to add washing soda to the water and then let the water settle five or six days before using.

Soap.—Soap making, which was formerly a common household process, is at present almost unknown. The lye which was obtained from wood ashes and the waste fat from various sources made a soap containing many impurities and of uncertain quality.

Soap may be made of any fat with caustic alkalies or lye. Chemically, lye is a hydroxid of either potassium or sodium—two closely related substances having similar chemical characteristics and producing compounds of similar nature.

When lye is mixed with a fat, it breaks up into the fatty acids and glycerine of which it is composed. The lye unites with the fatty acids to form a new compound, called soap, and glycerine is left as a by-product. This process is called saponification. As can readily be seen, the nature of the soap formed will depend, first, on the nature of the fats used, whether these are hard or soft, clean or rancid; second, on the kind of alkali used, whether caustic potash or

caustic soda; third, on the nature and amount of impurities contained in both fat and alkali; fourth, on the completeness of the process of saponification. If the operation of soap making is not properly conducted, the reaction between the fat and alkali is incomplete, and a soap is produced which contains free fat and an undue amount of free alkali. Such soap is greasy, unduly caustic, and a poor cleansing agent. Resin is often added to cheap soaps, and while a small amount is of value in that it whitens the clothing, the presence of large quantities should be considered an adulteration.

Home-Made Hard Soap.—Dissolve 6 lbs. of common washing soda in 4 gallons of warm water. Slack 6 lbs. of quicklime in just enough water to crumble it to powder, add the slacked lime to the soda solution, stir the two together, and add 4 gallons of boiling water. Stir it thoroughly, let it settle, and use the clear solution. To this add 12 lbs. of clarified grease, stirring in at the same time 4 ozs. of powdered borax. Let it boil until it becomes thick and soapy. Pour it into a box lined with muslin to allow the contents of the box being lifted out conveniently. Allow it to stand a few days, and then

cut it into pieces of convenient size. It will be ready for use in about a month.

It is not economy to use cheap and poorly made soaps in the laundry. Try soaps manufactured by reliable firms, and choose the one which is most satisfactory. A common mistake is to think that one kind of soap will answer for all purposes. In the manufacture of soap, when just sufficient alkali is used completely to saponify the fat present, the product is known as a neutral soap. If an excess of alkali is used, either a medium or strong soap is used, depending on the amount of free alkali left in the soap. The neutral or mild soap should always be used for woolen materials, delicate colors, and frail fabrics. A medium soap is best for durable colored goods, and a strong soap for most of the white materials. Much of the ordinary dirt on clothing is held by a fat of some sort. Soap in solution emulsifies the fat, thereby releasing the dirt. Any free alkali present unites with the fat to form soap which in turn aids in removing more of the fat. This shows why it is advisable to use a strong soap when there is much grease present.

Soap Substitutes and Accessories.—Soap is

the best cleansing agent for general use in the laundry, but there are other substances which may often be used to good advantage. Turpentine, kerosene, gasoline, and paraffin are useful because of their solvent action on fats. In dissolving the fat much of the dirt is set free. An objectionable odor may remain after using these solvents unless the clothes are thoroughly rinsed.

Most of the washing compounds on the market contain soap, an alkali, turpentine, paraffin, or fuller's earth. The best powders contain large amounts of soap and small amounts of alkali. What has already been said concerning the action of alkalies should serve as a guide to the laundress in choosing a washing compound if she desires to use one.

Bleach.—Sodium perborate (percil) is the most valuable household bleaching agent as there is little if any harmful effect on the material. It is also useful in washing white or light silks, as it prevents yellowing.

Bluing.—After repeated washing, white materials gradually acquire a yellowish tint unless carefully rinsed, and bleached in the fresh air and sunlight. Bluing has come into use to coun-

teract this. The abuse of bluing is that it may be used to cover up the results of careless work.

Indigo, originally of plant origin, but now manufactured artificially, was formerly the chief source of bluing compounds, but is little used at present.

Prussian blue is the most common source today. It is cheap, gives a good color, and is readily soluble. The objection to its use in the laundry is that it is an iron compound which is decomposed by alkalies, yielding iron rust. If clothes are not carefully rinsed until free of all soap and other alkali used in washing, contact with the bluing will result in tiny rust spots on the clothes.

Aniline blues give good, clear colors. Some may be used successfully alone, while others require an acid to develop them. Acetic acid or vinegar is preferable to oxalic as the former is volatile and has less action on the fiber. These blues actually dye the material and should, therefore, be used carefully.

Test for Presence of Iron in Bluing.—Prepare about a teaspoon of a strong solution of the bluing you wish to test. Add an equal

amount of ordinary household ammonia and allow it to stand from 15 to 30 minutes. A reddish brown precipitate shows the presence of iron.

Most of the liquid blues on the market are of this type. If a satisfactory bluing, free from iron, is not available, the objectionable results of Prussian blue may be overcome by the use of an acid rinse to neutralize the alkali. Two tablespoons of acetic acid or about a third of a cup of vinegar to a pail of water will be sufficient under ordinary circumstances. (The amount of alkali present in the rinsing water varies greatly and, therefore, no absolute rule can be given. A smaller amount might often be sufficient.)

Ultramarine blue is also an iron compound but it does not decompose with alkali. It is what is often bought as the ball bluing, and is insoluble in water. Water, however, causes it to break up into very minute particles which spread through the liquid and give it a blue color. The water must be stirred, and one must be careful in using it that the clothes do not get streaked.

Test four or five different kinds of bluing for

iron (small samples may undoubtedly be obtained from your friends).

To Set Colors.—It is always a safe precaution to set the color in most wash fabrics, and it is decidedly worth while for delicate colors. Any substance which will act as a mordant and cause the dye to be more completely impregnated in the fiber of the cloth will serve the purpose.

Salt acts as a mordant for the substantive dyes which are most commonly used for cotton and linen, and, therefore, may be used to advantage in the household to aid in making the colors fast. A handful of salt in a dish of cold water, however, is not sufficient. The material or garment must be placed in a strong, hot solution and allowed to stand until the water is cool to obtain the best results. If the material is to be shrunken before making up, the salt may be added to the bath and "two birds killed with one stone."

Because salt is cheap and on hand in every household, it is probably the best for general use. The effect of brine is said not to be lasting. There are other mordants which may be

used with equally good results, possibly better in some cases.

Sugar of lead is good for all colors except pink and blue.

Saltpeter is good for pinks and blues.

Vinegar is said, by good authority, to be best for pinks.

Alum is recommended for greens, mauves, purples, etc.

The following proportions should be used: To one gallon of water add ½ cup of mild vinegar, or 2 cups of salt, or 1 tablespoon of alum, or 1 tablespoon of sugar of lead (which is poison).

Experiments have shown that the best results are obtained when the fabric is treated before each washing, as the color is not permanently set.

The value of rinsing a blue garment in a strong bluing solution to counteract the faded appearance is appreciated by many. Other delicate colors would often profit by a similar treatment in a dye solution of the same color. By having bottles of various colored dye solutions at hand, little extra time would be consumed.

To Remove Stains.—The ordinary washing process is sufficient to get rid of most of the dirt in clothing, but some of the spots and stains require special treatment. The best and easiest time to remove such stains is as soon as possible after the misfortune has taken place. As this is not always possible, it is wise to go over the clothes to be laundered to see if any special attention is necessary. Some stains are insoluble in water, or soap and water, or may be made so by the action of heat, and thus become permanently set in the washing.

First, if possible, the nature of the stain should be determined. Second, some substance should be found in which the stain is soluble. With that accomplished, the removal will be a simple process. It is not always possible to find a solvent, and the next resort is something which will form a soluble substance. Should this also fail, the last possibility is the use of a bleaching agent. A bleaching agent should be used only when everything else fails, as it will remove the color and may weaken the fabric if not used with great care.

The various classes of stains will be taken up and methods of removal suggested. If one

does not work well in your particular case, try another. Always use some absorbent material under the spot so that the loosened dirt will not simply spread. Use a soft cloth, rubbing gently and softening the outline as much as possible.

When cleaning spots, run a thread around them so as to be able to find them easily after the garment is wet.

Before using any cleaner, try it first on the inside of a seam to see whether it will change the color.

To raise the nap of wool goods place a wet piece of the same material over the spot and iron with a moderately hot iron. The piece will adhere and the nap raise when pulled apart. Needless to say, if the nap is worn off this will accomplish very little.

A round bottle filled with hot water is superior to a flatiron for pressing seams in delicate goods.

Grease.—Many times it is grease that holds dirt, as has been suggested. Special care is necessary in that case only when the material is such that it cannot be submitted to ordinary laundry processes.

Solvents:

Alcohol,
Ether,
Chloroform,
Carbon tetrachloride (carbona),
Gasoline,
Naphtha soap and water.

Carbon tetrachloride (CCl_4) is also sold under the commercial name of carbona. They are one and the same thing, but the carbona costs about one-half more. The great advantage lies in the fact that this compound is not inflammable as most of the other solvents for grease, so may be safely used around lights and fire. It is too expensive to use when immersion of the article is necessary.

Gasoline is the most practical reagent for use when the entire article needs cleaning. It must be used away from the fire to avoid any possibility of serious accidents. Place the garment, well covered with gasoline, in a vessel which may be tightly covered, and allow it to stand several hours, or over night. If the gasoline is warmed by being placed in a dish of hot water, the dirt will be dissolved more quickly

and easily. Especially soiled places may require a little rubbing to aid in loosening the dirt. Rinse in clean gasoline and hang in the open air.

A pure, neutral soap may be used with gasoline, the same as with water. It is necessary, of course, to rinse the garment thoroughly in clean gasoline after using the soap. A commercial cleaner, Putnam's Dry Cleaner, the only commercial compound known by the author to be on the market at the time of this writing, may also be used with good results.

The soiled gasoline should not be thrown away, as the impurities will settle to the bottom and the clear gasoline may be poured from the top.

It is economy to use plenty of gasoline, as the results will be more satisfactory, and with proper care it may be used many times.

Wagon grease, if dried on, should first be softened with lard or oil and then washed in soap and water, or one of the solvents for grease may be used.

For *paint and varnish* probably the best solvents are: turpentine, alcohol, and ammonia.

Meat juice, blood, or mucus may be consid-

ered together, as all are protein compounds and react to similar treatment. Heat will coagulate these substances, as it would an egg, and for that reason must be avoided.

1. Soak in cold water, then wash with soap and water.

2. Add ammonia or salt to water, then wash with soap and water.

Milk, cream, and cocoa contain fat, protein, and, in some cases, coloring matter.

The same applies to tea and coffee if cream or milk has been added.

Use some fat solvent first, and then wash in cold water. Soaking in borax water after removing the fat may sometimes be necessary. Glycerine will aid in removing tea stains. Soak the spot in glycerine, and then wash.

Fruit Stains.—Fruit stains are held in the material by pectin, a gelatinous substance which makes it possible for fruits to "jell," as we say. This is soluble only in boiling water. Spread the stained surface over a dish. Pour boiling water through it from a height, so as to strike the stained part with force.

Glycerine has been found of some assistance in removing peach stains, and camphor for fruit

stains in general. Alcohol in boiling water is also a good solvent for fruit stains.

In the case of old stains it may be necessary to use a bleaching agent, as Javelle water. This may be used only on white materials, as it will remove the color also.

Iron Rust.—1. On white, wet the stained part with borax and water or ammonia, and spread it over a bowl of boiling water. Apply a ten per cent solution of hydrochloric acid (muriatic), drop by drop, until the stain brightens. Dip it at once into water. If the stain does not disappear, repeat the process. After removing the stain, rinse well with ammonia to neutralize any acid that may remain.

2. A ten per cent solution of oxalic acid may be used as above. Oxalic acid is not so detrimental to the fabric, but is a deadly poison even in the dilute solution and so should be labeled poison.

3. Wet the stained part with a mixture of salt and lemon juice. Place it in the sunshine. This is a much weaker reagent than the two preceding, and, therefore, will take a longer time, and is often not so effective.

4. The commercial ink eradicators may be

used in some cases. Rinse thoroughly after using them.

5. Erusticator, a commercial product, may be used satisfactorily in removing rust stains. It is a chlorine compound and acts as a bleaching agent. Rinse thoroughly after using it. Though there may be others designed for the same purpose, at the present time the author does not know of any.

Ink is often difficult to remove, as it varies so greatly in composition. It is well to experiment with a corner of the spot before operating on the whole.

1. If the stain is fresh, soak it in milk. Use more milk as the old becomes discolored.

2. Wet it with cold water. Apply oxalic acid to a stain on white cloth, let it stand a few minutes, and rinse it. Repeat until the stain disappears. Rinse it in water to which borax or ammonia has been added. This will neutralize the acid and prevent weakening of the fabric.

3. Commercial ink eradicators are most effective as a rule. The removal is accomplished quickly and with little detriment to the material if they are carefully used.

Milk is the only reagent given which will not destroy color.

Iodine or Medicine.—Iodine and many medicines are dissolved in alcohol, and, therefore, it is the natural solvent to use in removing the stains. Ammonia, chloroform, and ether may also be used. Ammonia is very good for iodine stains. A dilute solution of caustic soda or caustic lye may also be used.

Grass Stains.—It is the chlorophyll or green coloring matter in plants which is removed with difficulty. Alcohol is perhaps the best solvent. Ammonia and water may be safely used if the colors are not delicate.

Hydrogen peroxide may be used with ammonia and is more effective as it also acts as a mild bleaching agent.

Mildew is a true mold, and, like all plants, requires warmth and moisture for its growth. When the heat and moisture necessary are present in a cloth, mildew grows upon the fibers. During the first stage of its growth the mold may be removed, but in time it destroys the fibers.

1. Soak it in some acid, as lemon juice, vine-

gar, or buttermilk and salt and expose it to direct sunlight.

2. Wet it with a paste of soft soap and pulverized chalk. Expose it to sunlight.

3. Javelle water may be tried in cases of advanced growth. Success cannot always be expected.

Bleaching Agents

Javelle water, to be used as a bleaching agent, may be made as follows:

1 lb. washing soda,

½ lb. bleaching powder (calcium hypochlorite),

1 qt. boiling water,

2 qts. cold water.

Dissolve the soda in the boiling water in a granite pan and let it cool.

Dissolve the bleaching powder in the cold water; let it settle; pour the clear liquid into the soda; and let it settle. Pour off the clear liquid, bottle it and put it away in a dark place. This gives a 25% solution. Mixed with equal portions of water it may be used cautiously to remove spots. If materials are to remain in the solution for some time, it should be diluted to

about a 2% solution. Wash the material thoroughly in several waters and finally in dilute ammonia water.

To Clean White Shoes.—There are many preparations on the market, such as Albo, Buck White, Nuway, Bixby's White Shoe Dressing, and Whittemore's White Shoe Dressing, and many of them do good work. Directions for use are given on the bottle or box. Bon Ami is inexpensive and is on hand in many households. It may be used as follows: Brush the shoes to remove any loose dirt, and then apply a suds of Bon Ami and water with a small brush. When the water evaporates, the surface is covered with a thin coating of the Bon Ami. It does not, however, have the pasted appearance which many of the preparations give. While covering the dirt, it also partially removes the soiled spots.

To Clean White Kid Gloves.—1. Art gum, if used frequently for slightly soiled spots, will keep gloves in wearable condition for some time, postponing the necessity for a thorough cleaning.

2. A paste of gasoline and flour well worked into the gloves is effective. Care must be taken

to keep the gloves away from fire until the gasoline has entirely evaporated.

3. Carbon tetrachloride may be used.

Sulphur Dioxide Bleaching.—Javelle water or chlorine in any form cannot be used for silk or wool. For these the fumes of burning sulphur, or these fumes dissolved in water, must be used.

The garment should be wet or the special spots moistened and hung in some small enclosed space above a piece of burning sulphur. The sulphur candles, to be had at any drug store, are convenient for this use.

A cone of heavy paper may be used as the "smoking room."

To remove small spots, cut a small opening in the apex of the cone and hold the moistened spots above the opening so that they may be acted upon by the fumes.

"They that wash on Monday have all the week to dry.
They that wash on Tuesday are not so much awry.
They that wash on Wednesday are not so much to blame.
They that wash on Thursday wash for shame.
They that wash on Friday, wash in need.
And they that wash on Saturday—oh, they're sluts indeed." OLD ENGLISH PROVERB.

Let us forget if possible our prejudice in favor of Monday and determine whether it is not more sensible and convenient to have the weekly washing done on Tuesday rather than on Monday as has so long been the custom.

First the clothes should be gone over, locating spots and rents which need attention. "A stitch in time saves nine," is applicable here, as a small hole may be much increased in size during the washing process.

Soaking clothes over night is felt by many to reduce greatly the labor necessary in removing the dirt.

Saturday has many special duties already, and most housekeepers do not want to take the time for these preliminaries. It is not justifiable to take Sunday for it, and, therefore, Tuesday seems the more logical day for the laundry work.

Before continuing to wash on Monday, therefore, consider your individual case and be sure you have a better reason than that of custom only.

Many garments worn Sunday would suffice for another day's wearing if the laundress could wait for them until Tuesday.

Hanging Clothes.—Be sure the clothesline is clean. Clothes should be hung wrong side out, so far as possible, with the threads of the material straight. Sheets and other large straight pieces should be hung with the hems together and the hemmed ends pinned to the line to prevent whipping in the wind. Arrange, so far as possible, to hang garments so that the wind may blow through them. They will dry more quickly and with less injury to the clothes. Make a cheesecloth bag in which to dry dainty small articles such as doilies, embroidery, and fine handkerchiefs. The bag may be hung on the line.

Skirts will sometimes keep their shape better if hung by the waistband instead of the hem. A safe rule to follow is to hang the garment in as nearly the natural shape as possible. It is difficult to iron properly a garment which has been badly hung. It is worth while to shake and straighten articles before hanging them on the line, and also when they are taken down. This will save time in the preparation for ironing, and also in the actual ironing.

Much time may be saved by the busy mother in the home if knitted underwear, hosiery, many of the towels, etc. are not ironed. The absorp-

tive power is lessened by smoothing with a hot iron, and if they have been boiled and dried in the air and sunshine further disinfection should not be necessary. Sheets properly hung and carefully folded when taken down may be made to look very well if the upper end is simply pressed a little. The housekeeper and home-maker, confronted as she is with innumerable demands upon her time, must choose those tasks she considers most worth while if she is to be an efficient worker. An aluminum sprinkler which may be used in any bottle of convenient size, is a valuable aid in sprinkling clothes. It makes a fine spray and accomplishes the desired end quickly. It may be purchased for ten cents. Warm water is absorbed more quickly than cold, and should always be used when the clothes are to be ironed soon.

To Wash Woolens.—The characteristics of the wool fiber and its reaction to acids and alkalies have already been given, so the reasons for the following precautions should be understood. The temperature of the water is not so important as keeping the temperature the same throughout the washing and drying process. It is change of temperature rather than any par-

ticular temperature which causes the shrinkage. Tepid or lukewarm water is recommended, as that is at the temperature which can be most conveniently retained while drying. Never dry woolens close to a fire, as the steam formed will cause the material to shrink.

A neutral soap should be used in the form of a thin solution. Avoid rubbing soap on the fabric. Many prefer ammonia or borax to soap, and others use one or the other with soap. Borax or ammonia is especially valuable if the clothes are badly soiled or if the water is hard. Punch and knead the garment to loosen the dirt, but do not rub it. Use as many waters as necessary, being careful to have the temperatures as nearly the same as possible. Put it through a wringer which has been loosened, or squeeze the water out with the hands. Avoid twisting it as that also causes shrinkage.

The following method gives good results with little effort. Dissolve a large bar of pure, neutral soap in enough water to make 2 qts. of the solution. Keep it in a fruit jar and use it as it is needed. To this amount of soap use a cup of borax, or, for small washings, use eight times as much soap solution as borax. Place the soap

solution and borax in a receptacle containing cold soft water. Immerse the clothes and allow them to stand over night or for several hours. Rinse them in clean, cold, soft water and hang them to dry in a cool or cold place.

Recent experiments in the home economics department in the University of Wisconsin have shown that the use of cold water (as taken from the cistern or tap) and drying at room temperature gave the best results. The flannel in this way was kept white and fluffy and shrunk the least.

Knitted underwear and hosiery are kept in the best condition by drying them over frames, which may be bought or made. A thin board cut in the shape of the garment works well. In the case of sweaters, shawls, or such articles as may stretch or shrink out of shape, pin them to a sheet on the floor so that the garment corresponds to the original measurements.

Blankets should be brushed and shaken to remove all dust before putting them in the suds. Do not attempt more than one pair at a time, as they are clumsy to handle. Work as rapidly as possible. The less time consumed in washing and drying, the better. When almost dry, the

blankets should be brushed to raise the nap and make them fluffy. This not only improves the appearance but also increases the warmth. The more air spaces enclosed among the fibers, the less conduction of heat there will be, and, therefore, the greater warmth retained.

To Wash Laces.—Fine, delicate laces should sometimes be dry cleaned rather than submitted to water at all. To wash them, use a warm suds of a mild or neutral soap, to which has been added borax or ammonia. Squeeze rather than rub them to loosen the dirt, as rubbing is injurious to the delicate threads. If the lace is carefully basted to a piece of cheesecloth, less care will be necessary. After rinsing thoroughly, the lace should be stretched into shape on a smooth, round bottle, or pinned to a soft pad, being careful to see that all the points are held in place. Lace may be stiffened by rinsing in a mixture of two tablespoons of alcohol to one cup of water. Lace curtains should be brushed to remove all loose dust before placing in the soap solution. If curtain stretchers are not available, good results may be obtained by pinning the curtains out on sheets, if care is taken to have them straight and even.

Handkerchiefs.—If any member of the family has a cold, the handkerchiefs should be disinfected in some way. Boiling for half an hour will do. This may prevent the cold from being passed on to the rest of the family.

Machinery for the Laundry.—In this day of power machinery when men on the farm, and everywhere in fact, are doing all of their hard work with its aid, we still find the majority of women washing by hand as their grandmothers did. "In the good old way," do we say? Not if "we" happen to be the ones who are doing the work. Who is at fault may be a debatable question. Perhaps it is the woman who will not insist that she be given these mechanical aids, and it may be a selfish man who refuses to furnish the necessary money. Mr. Allan L. Benson, in an article in the October, 1913, number of *Good Housekeeping,* says women have not machinery because they lack "nerve." If he is correct, may they speedily acquire the necessary "nerve" from somewhere.

There are four types of washing machines which may be described briefly as follows:

1. The "Dolly" consists of a milking stool

which revolves in the center of a tub of clothes. This agitating of the clothes forces the soap and water through them and thereby removes the dirt. This may tear the clothes.

2. Another machine uses a perforated revolving cylinder which holds the clothes and an outer one for soap and water. The better machines of this type are arranged to reverse the action automatically or with divisions to prevent knotting of the clothes. If well filled with water and not overloaded with clothes, no harm can come to even delicate fabrics.

3. No cylinder is used in this type of machine, which cleans by oscillation, or rocking the clothes in soap and water. It is very satisfactory.

4. The principle involved in suction washers is that of pressure and suction. There is a lever attached to metal cones. These are pushed down against the clothes, then suddenly lifted away from them and out of the water. A suction so caused draws out the dirt which has been loosened by the pressing.

The following table gives the prices of the various types:

	Hand	*Water Motor*	*Electric Motor*
1	$10	$12.50 to $16.00	$50
2	$12	$37.50	$75 to $275
3	.....	.....	$100 to $125
4	$1 to $3.50	$16	$85

Note.—Most of these prices were obtained from an article by Miss L. Ray Balderston in the October, 1913, *Good Housekeeping Magazine.*

Many of the ordinary hand machines may be connected with a gasoline engine at little expense. A gasoline engine of 1½ horsepower equipped on a truck costs $40.

To use washing machines most efficiently there should be plenty of hot and cold water easily accessible, also a drain in connection with the machine to carry off the dirty water.

Mangles.—A mangle is a device to save hand ironing of the flat pieces. It is a great time and energy saver for the laundress. Mangles are of two types in general: hot and cold. The cold mangle simply presses out the creases without giving a gloss. The sterilizing power of the heat is lost in this case. A simple one which

may be screwed to a table can be purchased for $6 or $7. A stronger one with a table attached may cost up to $25. The hot mangles may be heated with gas and operated by hand or motor power. These usually consist of a hot steel cylinder and a cloth covered cylinder between which the clothes are pressed. The cost varies from $25 to $75.

The electric iron is far more efficient and satisfactory to use than any other. If electricity is available, an electric iron should be a part of the laundry equipment.

Before leaving the subject of laundering, a few words concerning the use of power machines on the farm may not be out of place.

It would be so easy on many farms to make use of the gasoline engine in running a washing machine, wringer, and mangle with just as great saving to the housewife as to the farmer when it pumps water for the stock or grinds the feed. Someone has suggested that the farmer has installed power machinery because it has meant dollars in his pocket. This is not so evident when labor saving machinery is installed in the home. Are there not other things of more importance, however, than the dollar which has

assumed such large proportions? The health, comfort, and happiness of the wife and mother surely deserve consideration.

It has been done and, therefore, it can be again. A young Wisconsin farmer told about getting his wife a power washing machine for her Christmas present. He connected it himself and the total expense was under $25. He also had running water in his home. "May his tribe increase."

Another solution of the laundry problem on the farm is that of a coöperative laundry in connection with the creamery. Fillmore County in Minnesota has such a laundry in operation. To quote from an editorial in the Sioux City, Ia., *Tribune:* "The record of this coöperative laundry is noteworthy. About 750 farm washings are done each month and the monthly cost to each family averages $1.96. There is probably an actual saving to each family through eliminating the expense of a washing plant in each home. But the other benefits far outweigh the money saving. Women and girls of the farm are relieved of a burden that has contributed largely to the dissatisfaction with farm life. They have more time to make the farm home

attractive for the men and boys, who thus share in the benefit. Social activities of this community will be stimulated and, in the long run, homes, schools, and churches will show increased efficiency through the release of women from the drudgery of the churn and the washtub."

CHAPTER VII

HYGIENE OF CLOTHING

At the present time much is being said and written about the conservation of health. How to keep well is of far greater importance than how to get well. There is even some talk of having municipal physicians paid a salary to prevent illness rather than cure those who have become the victim of disease. It is not, however, only a question of being sick or well, as the terms are ordinarily considered, but of caring for the body in such a way as to keep it at the highest point of efficiency. All should be interested in those things which will assist in keeping the body in such condition and conserving energy to the point where life will mean the most to others and to oneself. One should not be satisfied with a mere existence or even escape from the doctor's care. Proper clothing is one of the means of attaining this end and is, therefore, worthy of careful consideration.

While age, climatic conditions, and the occupation of the wearer all affect the ultimate working out of the problem, nevertheless there are some general principles which will help in the determination of what is best, considering the conditions of daily life.

One might ask the question, "Why do we wear clothes?" Different answers would naturally be expected, as the function of clothing is quite different under different circumstances. To summarize, the functions of clothing may be given (1) as a means of protection; (2) to satisfy our sense of modesty; (3) to satisfy our instinctive love of adornment; and (4) that we may appear like others, or be in fashion. In cold climates the protection afforded by the clothing worn is of primary importance, while to the naked savage in Africa, whose only clothing is a string of beads, love of adornment heads the list. Adornment and fashion are of first importance in the minds of many, and are alone considered when choosing clothing. Fashion should not be ignored, but neither should the extremes of the designer be followed at the expense of proper protection or the sacrifice of the sense of modesty. Compliance with the de-

mands of fashion is good up to a certain point. Unless dressed according to the prevailing modes the majority of people are uncomfortable, become self-conscious, lose their poise, and are unable to do their best work. One should strive to dress in such a way as to be unconscious of clothes. That is the condition which will make possible the largest amount of effective work. Someone has said, "To be well dressed is not vanity but sanity," and it is true when considered from the standpoint of the comfort and poise of the individual.

As mentioned above, age, climate, and occupation greatly affect the clothes problem. The infant, because of its proportionately large surface area, loses heat much more rapidly than the adult, and, therefore, must be protected by warmer clothing. Wool next to the child is necessary through the second summer. Old persons frequently feel the need of wool, because, since they are less active, their circulation becomes sluggish and it is, therefore, more difficult to keep sufficiently warm. It is impossible to lay down any hard and fast rules, as individuals differ in their requirements, but as a general rule the normal adult does not feel the need

of woolen undergarments. The warm houses and public buildings of the present time make it seem wiser to wear less in the house and then have a heavy wrap to wear out of doors.

One of the important objects of clothing is to aid in the maintenance of a uniform body temperature. The temperature of the normal, healthy individual is about 98° F. Slight variations may not be serious, but a change of two or three degrees one way or the other is a danger signal. The human organism maintains this constant temperature by either physical or chemical means. The physical means employed are, (1) varying the amount of blood sent to the skin, which regulates the amount of heat lost by conduction, convection, and radiation; (2) varying the amount of moisture given off through perspiration, and thereby affecting the loss of heat through evaporation. The chemical regulation is so called because it increases the amount of oxidation in the body. When the temperature is lowered, the nerves of the skin cause a constriction of the blood vessels supplying the skin, thereby increasing the blood supply of the internal organs. Increased oxidation increases the heat given off just as the

addition of fuel to the furnace means more available heat. Proper clothing decreases the necessity for the chemical regulation, saving energy and fuel (or food).

The physical properties of textiles which were given in previous chapters should be reviewed, as those which affect the conduction of heat, absorption, and evaporation of moisture are of importance in considering the hygiene of clothing in general, and especially of underclothing. Wool and silk are poor conductors of heat, and linen and cotton better conductors. Wool feels warm to the touch because it does not take heat away from the body. Linen and cotton feel cool and, therefore, make pleasant clothing for summer. The amount of air enclosed in the meshes of the fabric affects the conduction of heat even more than the nature of the fiber. Still air is a poor conductor of heat, and a cotton or linen fabric, if loosely woven or finished with a napped surface, is quite warm. Outing flannel is a good example of the effect of air spaces in increasing the warmth of a cotton fabric. Linen absorbs and gives off moisture rapidly, cotton and silk more slowly, and wool most slowly of all. The hygroscopicity, or the prop-

erty of absorbing moisture without seeming wet, is high in wool and silk and lower in linen and cotton. Wool may absorb 30% of its weight of moisture without feeling wet.

Loosely woven linen makes an ideal material for summer underwear because it absorbs and gives off moisture very readily, thereby cooling the skin. The high price is prohibitive for most people, so the linen mesh underwear is not much used. A knitted cotton garment does very well, and the lower price makes these garments more popular than the linen. Linen and cotton can be laundered much more easily than wool and silk, which is another point in their favor for use in undergarments.

Wool would make an ideal material for cold weather undergarments because of its low heat conduction, if it did not hold moisture for so long a time and "felt" in washing. Both objections may be partially overcome, especially the latter, by mixing cotton, linen, or silk with the wool. Infants, invalids, and aged people who exercise little and do not perspire freely, need the warmth of the woolen material, and for them the wool and cotton, wool and linen, or wool and silk garments are satisfactory. A light-

weight wool garment worn over a thin cotton one is found by some people to be a good combination. The cotton takes up the moisture readily and it is then taken up and given off slowly by the wool. This arrangement provides for the absorption of the perspiration and prevents the chilling of the body.

The average normal individual is more comfortable when clothed in cotton undergarments of various weights. Undergarments made of silk have a pleasant "feel" and the heat conduction is low. The price is prohibitive for most people, however, and it is, therefore, little used in undergarments.

It should be remembered that heavy and warm are not synonymous. A garment may be heavy and still not warm. Two light-weight garments are much warmer than one heavier one because of the layer of air between the two garments.

The requirements for outer and undergarments differ somewhat, as the garment worn outside should be such that the wind will not penetrate easily, while a loosely woven undergarment offers greater protection because of the spaces retaining heated air.

The importance of keeping clean the clothing worn next the skin can hardly be overestimated. The sweat glands of the normal adult secrete about three pints of perspiration daily, and most of this must be taken up by the clothing. When the pores of the cloth become clogged, proper absorption and ventilation are prevented, which means that the body remains moist and exposure to a draft causes a chill. Some fabrics are naturally cleaner than others. Linen contains less natural oil than cotton, and, since the fibers are longer, has fewer protruding ends to catch dirt and bacteria. Experiments show that about three times as much dirt clings to cotton as to linen, and about twice as many bacteria are collected by the skin when cotton garments are worn. Cotton fabrics, however, may be easily laundered, and the high temperature and soap used are satisfactory disinfectants. Cotton garments may, therefore, be kept in a sanitary condition if changed frequently. Wool furnishes an excellent feeding ground for bacteria, especially when soiled, and the difficulty with which it is laundered makes an added objection to its use next the skin. Sleeping between woolen blankets, which can-

not be washed frequently, is a most unsanitary practice, as the above statement indicates.

Many girls and women are not sufficiently careful about frequent washing of corsets and shields. Corsets may be easily and thoroughly cleaned by the use of a small brush and plenty of soapsuds. After rinsing in clear water and drying in the sunshine, the garment is as fresh and clean as when new. Shields should be soaked a few hours in tepid suds, prepared with a pure neutral soap and soft water, and rinsed in cold water. Hot water makes the rubber brittle, and should always be avoided. A brush may be used here also, but it should not be necessary if the shields are washed frequently. They should then be hung to dry in a cool place, never near the stove or over a register, as the heat will spoil the rubber. Shields may also be kept in good condition for several days if they are washed off each time the garment is removed. This may be done by using a cloth dipped in soapy water, and afterward one rinsed in clear water. Thus the shields need not be removed from the garment. They must be removed frequently, however, and washed thoroughly.

A word concerning the receptacles in which soiled clothes are kept may not be out of place here. A vulcanized or white metal holder is preferable to the more common wicker variety, since they can be kept clean and sanitary with little difficulty. The necessity for this is obvious, when it is remembered that large numbers of bacteria are found in soiled clothes. A washable bag of firm material, if kept perfectly clean, may be found satisfactory.

The Corset.—While it pleases fashion at present to have the waist large and the clothing worn loosely, in a few seasons the tendency may again be toward the small waist and consequent tight lacing. In considering the subject of proper clothing, therefore, we cannot omit a discussion of the results of constriction of the waist and chest by the use of a tight corset. There may be a difference of opinion as to whether the present modes, allowing greater freedom of movement and a possibility of deep breathing, are the result of education along these lines or whether it is simply a whim of the designer. We trust and believe that the trend at the present time is toward more sensible and hygienic dress for women. There are

still many women who are ready to follow all the extremes of fashion regardless of whether they are contrary to the laws of health or not. Yet there is an increasing number of women in America who adapt prevailing modes to their own individuality and to their ideas of what makes for health and efficiency.

It is believed by some that all corsets, however worn, are not only unnecessary but harmful as well. Others feel that the straight front corset with the large waist and space above the waist to allow of deep breathing, is not harmful if worn loosely. Many of the newer corsets are low in the bust, some coming just above the waistline. Women who have never worn corsets find this type comfortable. They give perfect freedom above the waistline and simply hold the abdomen in place and support the clothes at the waist.

The old hourglass type of corset which made the waist as small as possible, by pushing either up or down any flesh or organs which were in the way, should be condemned from every point of view. The downward pressure is especially harmful because it causes displacement of the organs located in that region.

Dr. T. Sadler, in "The Science of Living or The Art of Keeping Well," says on this subject: "Corsets restrict the breathing; they weaken the abdominal muscles; they displace the internal organs, favoring constipation, and indirectly contributing to the causes of indigestion and congestion of the liver and pelvic organs. The corset is indirectly chargeable with the vast amount of the sufferings of womankind usually designated as 'female complaints.'" The present day corsets, mentioned previously, cannot be charged with the evils spoken of by Dr. Sadler. The pressure in this case is low on the abdomen, where there are few organs, and serves as a support holding the organs in place instead of causing the downward pressure. With the possible looseness at the waist and above, there need be little if any interference with the circulation and deep breathing. The front laced corset is found to be more comfortable by those whose work requires that they sit most of the day. The pressure of the front steel on the nerve center causes discomfort in some cases and many doctors recommend the front lace corset because it does away with the steel in the front. Tight

garters on any corset are bad because of the downward pressure which should always be avoided for reasons already given.

Corsets are not necessary for the woman with strong muscles unless she has a large accumulation of fat at the abdomen which needs to be kept in place. Unless all garments be suspended from the shoulder, however, which is not always convenient, the discomfort from the bands at the waistline may be much worse than a loose corset giving plenty of breathing space. Hanging all garments from the shoulders may cause an undue strain on the back. This again is something which each individual must decide for herself, keeping in mind the general principles of health and hygiene.

Shoes.—Shoes should protect the feet from hard or sharp objects and from heat and cold. It is important that the feet be kept warm and dry, as cold feet are frequently responsible for colds, disturbance of the bowels, and inflammation of the pelvic organs. A physician who has had large experience in a children's hospital said that cold feet were the cause of more colic in babies than any other one thing. Cold extremities prevent proper digestion. Wearing

rubbers is not considered fashionable by some, but a pair of rubbers worn in stormy weather will save much discomfort and possibly several doctor's bills. Rubber is impervious to both perspiration and air, and, therefore, should only be worn when necessary. The low sandal variety are best under ordinary conditions. The question of wearing low shoes in cold weather should not be overlooked. The blood vessels are near the surface in the legs and arms, especially at the joints, as ankles and elbows, and consequently insufficient covering of these parts means a chilling of the blood. This undue loss of heat in the extremities means a proportionate congestion in some internal organ, with a possibility of serious results. It should be remembered also that such a loss of heat means a loss of energy which might have been stored up for use in time of emergency or expended in accomplishing something worth while.

The close fitting, extremely pointed-toed shoes with the absurd French heels cannot be too strongly condemned. High heels are especially harmful to young girls who are just developing into womanhood, and mothers should "think twice" before allowing their

young daughters to wear them. The natural shape of the foot should not be lost sight of in selecting shoes. It is unlike the hand in that the large toe, which corresponds with the thumb, is usually longer than the others, and instead of running straight ahead, as so-called "anatomical" shoes are built, slopes slightly outward. The shoe should, therefore, be somewhat pointed, slanting from both sides toward the center, although most of the slope should come on the outside, following the natural curves of the foot. The natural lines of the human foot are graceful and beautiful, and if we would only accustom our eyes to its real shape as displayed in properly fitting shoes, we would soon admire nature's work and cease futile attempts to improve upon it. Discomfort means lowered efficiency, and it is important, therefore, to have the feet, as well as the other parts of the body, comfortably clothed. Laced shoes can be more readily adjusted, and for that reason some consider them preferable to the buttoned style. If the buttons are properly placed when the shoe is purchased or after being worn for a few days, however, buttoned shoes may be satisfactory for the normal individual. Experience

with a large variety of materials has shown leather to be the best for general use. For shoemaking purposes it is unsurpassed because it is tough, flexible, porous, and reasonably waterproof, and has a moderate degree of ventilation. It is not ideal because it retains heat and perspiration to an undesirable degree, has an unpleasant odor and cannot be kept clean, to say nothing of sterile. The same pair of shoes should not be worn constantly, since they do not become thoroughly aired and dried out during the night. It is more satisfactory and economical to have two pairs of shoes for ordinary wear, and change frequently.

Just a word about the selection and care of stockings. It would be ideal from a hygienic standpoint if white hosiery could be worn all the time, but for obvious reasons this is not convenient. The dye used in black or colored hose may cause trouble if the skin is bruised and broken. Numerous incidents could be cited of blood poisoning being caused in this way. Sometimes it has meant being laid up a few days, and occasionally even the loss of a limb. How to prevent such a situation is the question which interests us. Something may be told

about the permanency of the dye by moistening the handkerchief or any piece of soft white cloth and rubbing the stocking. If the cloth is stained the stockings will crock when worn. Tight or ill fitting shoes frequently cause blisters which result in trouble. If the shoe rubs at the heel and begins to redden the skin, a thin piece of velvet pasted in the shoe, with the napped side next to the stocking, will prevent friction. Stockings which are too short are uncomfortable and do not wear well because of the constant pressure. On the other hand, if they are too large the surplus forms in creases or folds which are also uncomfortable. The "happy medium" of a perfect fit should be arrived at if possible for the sake of comfort and economy. For the person with sensitive feet the right and left hose, which are now manufactured, are advisable, but are unnecessary for the normal individual.

One Piece Garments.—From the inside out, one piece garments are best from a hygienic standpoint. They are more comfortable, as all who have tried both will testify. Extra bands and layers of materials are eliminated. Such garments may be worn loose, since they are

held in place, always looking neat and trim. Union suits are constantly gaining in favor, also combination suits, princess slips, and one piece dresses. Fashion is partially and perhaps largely responsible for the trend in that direction, but however that may be, we trust that the condition may become even more prevalent in spite of changes in fashion.

Long Skirts.—The wearing of long skirts on the street is most deplorable from a sanitary standpoint. Any thoughtful woman can easily realize that quantities of dirt and millions of bacteria are picked up by the skirt as it sweeps over dusty walks and streets. These are naturally distributed over the body and the disease producing bacteria may cause trouble.

Collars.—The dressing of the neck has been the subject of much discussion, and there are various opinions held at the present time. There are some points, however, which are generally conceded, and a knowledge of these will help in solving the individual problem. High, tight collars interfere with the circulation and may affect the eyes. Exposure of the throat and chest in cold weather is unwise for the average individual, as it means an undue loss

of heat and energy. It is just as unwise, however, to bundle up the neck with heavy furs or mufflers. This excessive covering of the neck and chest causes the skin to perspire freely and become tender so that the least exposure to cold results in congestion, thus increasing the possibility of sore throat, colds, and pneumonia.

Hats.—Large or heavy hats are uncomfortable, either because of the weight or the difficulty with which they are balanced. Nervousness and an unnatural position may result because of the effort to balance and maintain the poise. Tight hatbands affect circulation and cause discomfort. Men err on this point more frequently than women but when the mode in vogue calls for the close fitting hat for women, it is well to have this possible danger in mind.

Veils.—Care should be exercised in selecting veils, as those which contain spots or figures are hard on the eyes. If the figures are far enough apart, so that they need not come in front of the eyes, this annoyance may be eliminated. Washable veils should be purchased so that they may be kept clean. Veils become soiled the same as anything else, and as they come in

contact with the mouth and face, it is especially important that they be kept clean.

It hardly seems necessary at this time to refer to the wearing of garments at night which have been worn during the day, but lest there be some who have never thought of the necessity of airing, especially the undergarments, we are mentioning it here. The discussion concerning absorption and evaporation of perspiration explains the reasons for this. The union suit, shoes, and stockings should be placed where they will be thoroughly aired during the night. The dress or waist should be hung either wrong side out, or at least with the inside and shields sufficiently exposed so that they are well aired.

If one is not sufficiently warm without the underclothing at night, a separate suit should be used. Aside from the reasons already suggested, the added bodily comfort is an important fact. For greater warmth sleeping garments of wool or heavy cotton flannel may be worn. They may be purchased ready-made in various styles, or they may also be made at home. One style, more especially for children than adults, is made with a draw string in the bottom giving extra protection for the feet.

Large pockets near the bottom of the gown furnish a warm, cozy place for the feet on a cold night. Garments are also made with feet using either knitted material or cotton flannel. Those are especially nice for children. The use of sleeping bags for children who are restless at night and "kick the covers off" will save a great deal of worry on the part of the mother. These may be made of a fourth of a blanket folded together the shape of a pillowcase. It can be held together by coat hooks fastening on the shoulders. A sweater or heavy woolen jacket must be worn to keep the arms and shoulders warm. Mittens or sleeves long enough to cover the hands will be needed, as the hands should be kept outside. This is important as it removes the temptation of self-abuse.

To quote from "Textiles" by Woolman and McGowan: "When all is said, personal environment and idiosyncrasy must influence an individual's choice of textiles and manner of dress. Wool may be the right material for one case, because it does not permit rapid evaporation of moisture; in other cases, this property is disadvantageous. The value of the study of the hygiene of clothing lies in the ability it gives to

make an intelligent adjustment of clothing to one's needs, and further, to see the value of dressing according to good sense rather than fashion. Women are flagrant offenders, but not all the efforts of the clothing reformers should be directed at them. As a whole, the clothing for men shows superior good sense to women's, but men's attire is quite deficient in its adjustment to heat regulation, nor can much be said for some of its details, such as stiff, unventilated hats and stand-up collars. It may be unusual to defend women's hats, but from a hygienic standpoint they are generally better than the derby and top hat."

CHAPTER VIII

THE ECONOMICS OF CLOTHING

"It is estimated that nearly $15,000,000,000 are spent annually in the United States in household maintenance for the items of food, shelter, and clothing. Omitting the $2,650,000,000 that man spends for tobacco and intoxicants, it leaves over $12,000,000,000 spent on food, shelter, and clothing. Over this expenditure woman has more or less complete control." This is quoted from the bulletin describing the courses offered in the Home Economics department of the University of Wisconsin. While the production of food and clothing is largely in the hands of men, the consumption or use of these goods or products is directed by women. Dr. Edward T. Devine of Columbia University says, "To woman has fallen the task of directing how the wealth brought into the house shall be used; whether much or little shall be made of it, and what kind of wealth shall be brought."

He says also, "There are three ways in which prosperity may be increased: We may choose more wisely what things we shall produce; we may produce more efficiently; we may consume more economically. The wiser choice and the more economic use alike fall within the range of what in economics is called consumption or demand." After pointing out that the third method has greater immediate possibilities than the other two, and that the first is more important than the second, he adds: "It is the present duty of the economist to insist upon this, to magnify the office of the wealth expender, to accompany her to the very threshold of the home that he may point out, with untiring vigilance, its woeful defects, its emptiness caused not so much by lack of income as the lack of knowledge of how to spend wisely."

Perhaps these quotations from authorities in this line will help to a realization of the responsibility which rests on the shoulders of every housekeeper and all other women who are spending unwisely their share of the $12,000,000,000. The purpose of this chapter is to give a few suggestions which will help in solving the clothing problem.

The majority of thoughtful women should be and are interested in obtaining the information which will make it possible for them to buy most wisely the things needed for themselves and their families. The home is the greatest factor in the happiness of the race, and in it woman's part is supreme. As she becomes more intelligent in selection and purchase, the home increases in value and attractiveness. Training for economy in consumption should raise the levels of social life. If a person chooses to spend an undue amount on clothes or is wasteful in buying because of ignorance, there must of necessity be that much less for education, travel, recreation, and other forms of higher life.

Dress has an influence on the wearer as well as on the observer. One loses her self-respect when dressed in ragged or soiled garments. A woman who is over-dressed or inappropriately dressed is uncomfortable herself and wins the respect of others with difficulty. Good nature may be increased or decreased according as the clothes worn are clean, comfortable, and appropriate, or the reverse. Perhaps on first thought it may seem an exaggeration to say that

neat clothing is a factor in virtue, but observation will prove that it is easier "to be good" when one is properly clothed.

Dressing Economically.—There are differences of opinion as to what is the most economical method of dressing, and it is perfectly reasonable that it should be so, since what is economy in one case may be an extravagance under different circumstances. There may be individual preferences, also, which deserve consideration. Some women prefer a number of inexpensive ready-made garments to a few high priced ones. In some homes most of the sewing is done in the house, a dressmaker coming each season to assist the mother and daughters with the making of new garments and remodeling old ones. Some ask if the time, energy, nervous strain, and results obtained warrant the use of this method. That depends on the attitude of the workers and the ability of the dressmaker. Some women enjoy sewing if someone plans and directs the work. Many others feel that the saving of time and worry when garments are purchased ready-made balances the additional expense. The business woman, who has little free time, cannot afford to use her

leisure in sewing, or even in selecting materials and having the fittings required by the ordinary dressmaker. A woman with a normal figure can find ready-made garments which require little if any fitting. For such a one little time is required for shopping.

Ready-made garments are being made more simply and of a better grade of material than formerly, so that one trained to appreciate good material and good design is able to select satisfactory garments at a reasonable price. Some professional women prefer another plan. They order their gowns at the higher class customs tailors or dressmakers. The best material is purchased and "exclusive" styles are chosen, avoiding extremes so that the garments may be used two or three seasons without alteration. They feel that they thus preserve the dignity and individuality of dress without spending too much time or money on it. Others of this type are satisfied with the best of ready-made garments, and they save the time which would be spent with the tailor. There is also a large number of women who use a combination of several of the methods suggested. Suits, coats, and tailored skirts, for example, may be purchased

ready-made; afternoon and evening dresses may be made by a good dressmaker; and the plain sewing may be done at home. This is only suggestive, the object being to bring to mind the various methods which have proved successful.

Someone has well said: "Economy lies in getting few things, but good ones. It is manifest economy to get a suit or coat that will last and look well for two years or more; also to choose a conservative color and style, so that the suit will not be conspicuously out of style the second season." This principle, referred to several times before, can hardly be over-emphasized. Cheap things are never economy if durability is a desired quality. A standard material, as serge, always gives better value for the money than a material of some new weave. It costs no more to make up good, durable material than poorer qualities, and since the garments made of cheap, slimsy material must be replaced after a short time, the apparent economy in the initial purchase is found to be a wasteful extravagance. The young girl who is earning five or six dollars a week is unwise when she purchases a suit of a

striking color and design. In a short time the attractiveness has largely disappeared. If the same amount of money had been put into a serge suit of conservative color and style, it would continue to look well for two or three years. To be sure young girls like bright, showy things and tire of the plain, serviceable materials. It is perfectly natural that they should have this desire, and it should be satisfied in so far as is consistent with the amount which may be spent for clothes. This color can be obtained much more economically, and satisfactorily in the end, by the use of collars, ties, belts, etc. The girl or woman of small means, after thoughtfully considering all sides of the clothes problem, will find a joy and satisfaction in the planning and scheming which will go far toward making the limited allowance buy the articles needed.

When purchasing leather goods, as shoes, gloves, purses, etc., remember that good leather is not cheap, and also that cheap or imitation leathers are not durable. A pair of good, well made shoes will often outwear two pairs of cheap ones. However, shoes are not always durable in proportion to the high price. The fine, soft kid are expensive but not durable, so judg-

ment must be used. It is always economy to have at least two pairs of shoes at a time, since they wear longer if allowed to become thoroughly aired and dried frequently. One pair of gloves at $1.50 or more gives better service than three or four pairs of cheap ones. This does not mean that expensive gloves may not occasionally be purchased at a reduced price. To be sure that one is getting a "real" bargain one must either be a good judge of leather, or make the purchase at a reliable store. Good kid may be repeatedly cleaned, while a poor quality often looks bad after a few treatments.

There are people who wear cheap hose as long as possible before mending, and then throw them away. Any thoughtful person can see the extravagance of this practice from every point of view. Buying good stockings is economy of time, when repairs are considered, and of money, because of the greater length of life.

There are two types of hosiery, the seamless, and the full-fashioned. The seamless, as the name implies, is made without a seam, and the full-fashioned has a seam at the back and on the sole or sides of the foot. Most of the seamless hose are knitted in one circular piece,

leaving an opening at the toe to be looped together. The leg, heel, and toe are then shaped by steaming and then drying on boards of the proper form. There are exceptions to this general rule, as one manufacturer controls patented machines whereby the knitting and shaping are accomplished in one process. The advantage of this type is in the lack of seam which may be uncomfortable; the disadvantage is that they lose their shape in time. The full-fashioned stocking is knitted on machines with the needles arranged in straight lines which automatically drop the requisite number of stiches at various points so that when sewed together it will conform to the natural shape of the foot. This type of hose fits the ankle snugly, and for that reason is preferred by many critical women. The discomfort of having the seam on the sole of the foot has been obviated in some cases by placing the seams on the sides.

Cotton hosiery varies in price and durability according to the quality of fiber used. The long stapled varieties produce the best and strongest hose, and it is economy to pay the extra price for this grade. A lisle stocking is one manufactured from lisle thread, which is made

out of combed Egyptian cotton tightly twisted and run through a gas flame to remove the lint always seen on other yarns made from cotton. This singeing does not injure the yarn, but gives the stocking a firm, wiry feeling. A silky appearance is given to either the cotton or lisle thread by the process of mercerization. Mercerization increases the strength of the fiber and also its affinity for dyestuffs. The better grades of cotton are apt to be used when the stocking is to be mercerized, and so for these reasons mercerized hose usually wear better and hold the dye better than ordinary cotton. Silk hosiery may be made from pure, reeled silk or from spun silk. Spun silk is less expensive than the reeled, but it is not durable. Good silk stockings are not cheap and it is necessary to pay at least one dollar for durable reeled silk hose. The life of silk hose may be appreciably lengthened by rinsing them in warm or cold water each night after they have been worn during the day. This may be done easily if running water is available, and will be found worth while.

The selection of color is important, not only from the artistic point of view, but also when

the money side is being considered. The woman who is spending only a small amount on her clothes cannot afford to buy vivid, striking, or queer colors which do not harmonize with other things and are so conspicuous that, once seen, they are remembered. Unless one's circumstances are such that a suit or a dress may be discarded after wearing a few times, novelties in color and style should be avoided. The woman with a small clothing allowance should adopt a color scheme limited to those colors that are becoming and that harmonize. Use a staple color, as navy blue, soft brown, or green as a foundation, with gloves, hats, neckwear, and other accessories in harmony. The economy of this is evident, as fewer garments will serve all occasions. Navy blue is the safest color to choose, as it is becoming to almost everyone and can be purchased in all standard materials. The woman with brown eyes or red hair will find brown, green, or black most becoming, and, therefore, most suitable. White material is usually most economical for summer wear because it may be laundered more frequently and easily than colored materials. The design of a white garment is usually less conspicuous than

any color and so may be worn for a longer time. The soft ratines and crepes, requiring little if any ironing, have helped to solve the laundry problem and thereby removed the objections to wearing white.

The problem of economy in hats is not so easily solved as some others. Good millinery materials are not cheap, but the artistic skill of the milliner is far more expensive. Therefore, if a woman can make or trim her own hats she will be able to effect a great saving. This requires skill not possessed by the average girl or woman. It may be acquired to some extent, but requires time. Exchange of work may be more practical in some cases. A woman with this artistic skill might be very glad to trim a hat in exchange for some sewing or mending. There is a difference of opinion as to whether it is better to get a more expensive hat and wear it two seasons or to get a cheap one every season. If the style is extreme and not likely to be good a second season, it would be much wiser to choose an inexpensive shape with perhaps more expensive trimmings which could be utilized again. Heavy satin ribbon is a durable material for trimming, and while rather expen-

sive to begin with, it will stand wear and tear better than most trimmings. Good ostrich plumes in black or white may be used several seasons if given good care. Artificial flowers are not economical usually. Close bunches of small flowers or buds with plenty of foliage stand exposure better than large, loose roses or other flowers. Faded flowers may be recolored quite easily. Any one with a very little skill can freshen up old flowers with water color paints. A simpler method requiring no particular artistic ability is as follows: Mix oil paints with gasoline or benzine until the desired shade is obtained, then immerse flowers in this mixture. They must be kept away from fire of any kind until perfectly dry. Cheap felt soon loses its shape and looks badly, while a good felt hat of a conservative shape will look well for several seasons. Black hats are generally most economical, as they go with everything and are most easily freshened and cleaned.

What Is a Bargain?—Is there anything which so delights the heart of a woman as being able to take advantage of a bargain? Everything placed on the counters where a bargain sale is advertised is not necessarily a real bargain.

The salesmen have discovered that many women do not exercise their judgment when attending such sales and have learned to take advantage of this. The following incident illustrates this fact. A clothing store in Michigan had a slight fire, and some of their goods were mussed and soiled by the water and smoke. To get rid of these damaged goods a fire sale was advertised. The people thronged to get the bargains offered, and continued to come after all the sale goods had been sold. The merchant did not like to disappoint the crowds, so had the clerks take new, fresh materials and wipe the floor with them to make them look like the others, and then for their trouble the price was raised a few cents. The crowd eagerly snapped up "the bargains" and went away happy. When attending a sale of any kind, one should look for legitimate reasons for the reduced price. Broken lots and odd sizes must be gotten rid of, even at a sacrifice. Soiled garments do not sell readily at the regular price, and the merchant is glad to make a reduction to get rid of such garments. In such a case, if the garment be one which can be laundered and the reduction more than covers the cost of launder-

ing, this may be termed a legitimate bargain. The same may be said of mill ends, remnants, samples, and novelties such as belts, bags, and collars. Seasonal sales also furnish an opportunity for economical purchases. For example, the January white goods sales have become an established custom in many stores. Real bargains may be found at such times.

Rubber goods and silks, which deteriorate rapidly, are frequently put on sale in order to dispose of them quickly. Sale silks are seldom economical, and unless you are allowed to test a sample and find the silk unweighted, beware. A weighted silk which has been in stock for some time will seldom wear long enough to pay for making up. A young woman bought such a silk and after keeping it a few months took it to the dressmaker. The waist was cut out but never basted together, because when the pleats were laid it split in the creases. Occasionally there will be found in the lot an unweighted silk which is really a bargain. Another danger encountered in bargain sales is the temptation to buy things that are not needed at the time, and with no prospect of an early future need. A story is told of a woman who

was fascinated by sales of all kinds. She frequently brought home purchases which greatly amused the family. One day, after attending a secondhand sale, she returned with a doorplate on which was engraved the name Thompson. When asked what use she expected to make of a doorplate with Thompson on it, she replied that she thought one of her daughters might marry a Mr. Thompson and then she could give it to them. Perhaps this seems almost unbelievable, and yet women are constantly buying things for which they have as little need. Benjamin Franklin said, "Buy what thou hasn't need of, and ere long thou shalt sell thy necessaries." This does not refer to buying staples in quantities. It is wise to put in a supply of thread, needles, pins, tapes, bias bindings, and such things, that are frequently needed. This will save the inconvenience and loss of time caused by numerous shopping trips when these things happen to be needed. Staple cotton materials, hosiery, undergarments, and such other materials and garments not largely affected by fashion may be purchased in quantities out of season when the price has been reduced. Suits, coats, etc. may be purchased late

in the season at about half price. If one is willing to wear plain tailored styles, which do not change so radically from season to season, instead of the extremes, fads, and novelties, it is possible to dress well on a smaller amount of money. A person of small means should not attempt to keep up with all the fads, which soon lose their attractiveness and, therefore, necessitate frequent changes, if one is to appear well dressed.

Buying staples in large quantities and buying out of season necessitate an income beyond the amount needed from day to day. Unfortunately those who need most to economize are unable to take advantage of such method of economy.

There are many who, either because the income is small or because of a lack of planning, buy on the installment plan. An investigation made in New York city showed that from 20% to 100% more than regular price was paid when the installment plan was used. It is unfortunate that those who need to economize most, frequently shop in this way.

Cash and Charge Systems.—There are advantages and disadvantages in both the cash and the charge systems. Each individual must de-

cide which seems wisest and most convenient in her particular case. Having an account gives standing in a store and may insure more courteous and careful treatment. It also saves time in shopping and gives an itemized account at the end of the month. On the other hand, it has a tendency to make one more extravagant and less careful in buying. In that case the cash system is far better even with its disadvantages. Paying cash is a good habit to acquire.

For the woman of ample means there is protection in shopping in the high grade store. The sales people are usually more intelligent, only better grades of materials are carried, and the firms are more nearly reliable, since the merchants wish to keep up their reputation, and will "make good" any purchase which is not as represented. Such stores have sales at stated times and seasons where "legitimate bargains" may be found. Frequently stores of this type have a basement where cheaper materials are sold, and sometimes the same articles may be found in the basement at a considerably lower price. For example, an umbrella which cost $5 if purchased upstairs was only $3.48 in the basement. The same was found true in

buying raincoats. A saving of from $2 to $3 was possible by making the purchase in the basement. The reason for this is quite evident when the difference in the furnishings, type of clerk, rent, operating expenses, etc. are considered. If a department is made attractive with velvet carpets and other expensive furnishings, and if there are attractive, well dressed clerks to wait upon us, we should keep in mind the fact that all this is paid for by increased prices of articles sold under such conditions.

Everything in cheap stores is not inferior in quality, but unless one is a good judge it is often difficult to distinguish the good from the poor. Deceptive methods of advertising and selling are used which further confuse the inexperienced shopper. One who is capable of judging materials may get satisfactory fabrics at a lower price than in the high grade store. The less aristocratic store can sell cheaper because rent and operating expenses are lower, and they do not carry the high priced novelties which entail great losses.

A knowledge of sewing is an economical asset to the woman who has time which may be

spent in that way. The woman who understands the principles of garment making so that she may work to advantage can save many dollars in the course of a year. Some dressmakers are not only willing but glad to design, cut, and fit, and leave the finishing to the woman herself. A high-priced dressmaker can accomplish a good deal in a few days by that method at a considerable saving to the woman employing her.

Undergarments, simple waists, and dresses can be made at home easily, and are often more satisfactory than the ready-made garments, because better grades of materials and trimmings will be used and the style and fit may be better.

Care of Clothing.—Proper care of clothing plays an important part in the clothes problem if one wishes to appear well dressed on a small or even reasonable amount of money. The appearance of the most beautiful garment is greatly impaired if mussed, spotted, or minus a hook, eye, or button. On the other hand, a simple dress of inexpensive material, if in good repair and correctly put on, gives one a well dressed appearance. The careful brushing of clothes which have been worn on the street is

a point frequently neglected, but is one which adds much to the appearance and life of the garment. Knowing the best methods of mending various materials is a great advantage. Woolen materials can often be darned with threads of the material, split silk, or hair so that the garment may again be presentable. Muslin undergarments, if neatly repaired, may be kept in a wearable condition for a much longer time. The ribbed top hose may be stretched and then stitched on the machine just where the ribbed part is joined to the lower part. This will prevent the runners, caused by the fastening of garters, from being continued below the ribbed portion. When purchased, knitted underwear may be reinforced at the places receiving most strain and wear. The additional strength at these places will help to prevent the appearance of holes. Shoes which are "run down" at the heels give the wearer an untidy appearance. More than that, this lack of proper balance spoils the shape of the entire shoe, and makes it wear out sooner. It does not cost much to have the heels straightened on a pair of shoes, and money spent in this way is often an economical expenditure. It costs but little

more to have rubber heels put on at this time, and the luxury of rubber heels means added comfort in walking. Many women say that to be neat in appearance is the greatest task of their lives, and it would seem that the time expended in keeping clothes in order and putting them on correctly is greater than all other essentials. Yet all these precautions are well worth the effort.

Clothing Budgets.—A consideration of the proportion of the income which should be spent for clothing, and how that amount may be most wisely used, is of value. Such a study gives us the benefit of the experience of others and makes us think about the garments which will be best suited to our needs. This planning will naturally reduce expenditures, as any one knows that haphazard buying is extravagant. For the person on a salary there is quite an advantage in planning the purchases from month to month and year to year. In this way it is possible to avoid having an undue proportion of purchases come in one month or one year. If this is not considered, a suit, waist, hat, shoes, and gloves may all be needed at the same time without sufficient money to pay for them. The

same is true of garments for the year. Coats, suits, furs, etc. should be distributed so that all are not purchased from one year's salary.

Studies of thousands of family and personal clothing budgets show that the amount spent for clothing varies from 12 to 17 per cent of the money received. Circumstances vary the amount which must be spent. For example, a teacher or a woman in business, who must always be well dressed, must spend more money for clothing than the woman in the home who is most neatly and properly attired for at least part of the day in a simple cotton house dress. The climate also affects the kind and amount of clothing needed. There is a value in keeping one's clothing account from year to year, since it shows what purchases have been made, and a study of it in comparison with other clothing budgets may show how better results could be obtained for the same or a smaller expenditure. A typical family budget and the budget for a business woman are given as illustrations.

Family Budget.—The following is an actual account of a family living in Madison, Wis. The father is a stone hauler and gets $4.50 a day—

$108 a month, or $1,296 a year. There are three children: a girl of sixteen, a boy of ten, and a girl five years old. The mother does most of the sewing for the children and herself. The older girl works at the telephone office and gets $5 a week, some of which she uses as spending money and to help buy some of her clothes. She saves $10 a month. The family owns the small cottage in which it lives. The amount spent for clothing is about 14% of the total income of the father, or $174.30 a year. This is not counting the extra amount that the older girl spends out of her own money. She spends for clothing about $40 a year of the money she earns.

THE FATHER'S BUDGET

Articles	Purchase	Service	Cost a Year
1 suit clothes, $16.....	ready-made.....	2 years	$8.00
1 suit clothes, $12.....	ready-made.....	2 years	6.00
2 pairs overalls.....	ready-made.....	1 year	1.00
1 hat.....	.....	1 year	1.50
1 cap.....	.....	1 year	1.00
Gloves and mittens....	.....	1 year	1.50
1 overcoat, $10.....	bought at sale.....	2 years	5.00
1 sweater, $5.....	.....	2 years	2.50
2 winter shirts.....	.....	1 year	1.50
3 summer shirts.....	.....	1 year	1.25
2 winter undershirts...	bought at sale.....	2 years	1.00
2 summer undershirts..	bought at sale.....	1 year	.50
Carried forward			$30.75

Articles	Purchase	Service	Cost a Year
Brought forward			$30.75
2 pairs fleece lined drawers	.....	1 year	$1.00
2 pairs summer drawers	.....	1 year	.50
Handkerchiefs	.....	1 year	.25
3 collars	.....	1 year	.30
4 ties	.....	1 year	.70
3 pairs shoes	.....	1 year	9.00
6 pairs hose	.....	1 year	1.50
Total			$44.00

The Mother's Budget

Articles	Purchase	Service	Cost a Year
2 hats, $6	trimmed at home	1 year	$6.00
1 coat, $10	bought at sale	2 years	5.00
1 spring suit, $15	bought out of season	2 years	7.50
1 wool dress, $4	made at home	2 years	2.00
2 wash dresses	made at home	2 years	4.00
3 white waists	made at home	2 years	1.50
2 white petticoats	made at home	2 years	1.00
1 black petticoat	bought at sale	1 year	.75
3 aprons	made at home	1 year	.50
1 pair gloves	.....	1 year	1.00
3 pairs shoes	odd size	1 year	5.00
6 pairs hose	.....	1 year	1.50
6 handkerchiefs	bought at sale	1 year	.30
2 winter union suits	.....	1 year	1.20
2 summer union suits	bought at sale	1 year	.60
2 gowns	made at home	1 year	1.00
4 corset covers	.....	1 year	1.00
2 corsets	.....	1 year	2.00
2 pairs drawers	made at home	1 year	.30
Sundries	.....	1 year	1.00
Total			$43.15

For Boy of Ten

Articles	Purchase	Service	Cost a Year
2 caps, $1	.....	1 year	$1.00
1 suit, $8	bought at discount..	2 years	4.00
1 suit, $5	bought at discount..	2 years	2.50
3 waists, $1	made at home.....	1 year	1.00
1 sweater, $5	.....	2 years	2.50
8 pairs hose, $2	.....	1 year	2.00
3 pairs shoes, $9	.....	1 year	9.00
2 winter union suits, $1	bought at sale.....	1 year	1.00
2 summer union suits, $.50	bought at sale.....	1 year	.50
1 pair mittens, $.50	.....	1 year	.50
1 pair trousers, $1	bought at discount..	1 year	1.00
Total			$25.00

For Girl of Five

Articles	Purchase	Service	Cost a Year
1 bonnet	.....	1 year	$1.00
1 hat	.....	1 year	.75
1 coat	made over from grown person's dress....	2 years	.50
2 wool dresses	made over from grown person's dresses...	1 year	.50
4 wash dresses	made at home.....	1 year	2.00
1 pair mittens	.....	1 year	.25
3 white aprons	made at home.....	1 year	.75
3 white petticoats	made at home.....	1 year	.50
2 pairs shoes	bought at sale.....	1 year	1.50
2 pairs slippers	bought at sale.....	1 year	1.50
2 wool union suits	.....	1 year	1.00
2 summer union suits...	bought at sale.....	1 year	.30
3 pairs drawers	made at home.....	1 year	.45
2 underwaists	.....	1 year	.25
Carried forward			$11.25

Articles	Purchase	Service	Cost a Year
Brought forward			$11.25
8 pairs stockings	.....	1 year	1.20
Handkerchiefs	.....	1 year	.20
2 gowns	.....	1 year	.50
Total			$13.15

For Girl of Sixteen

Articles	Purchase	Service	Cost a Year
2 hats	trimmed at home	1 year	$6.00
1 coat, $15	bought at discount	2 years	7.50
1 sweater, $6	.....	2 years	3.00
1 wool skirt	made at home	1 year	4.00
1 winter dress	made at home	1 year	6.00
4 wash dresses	made at home	1 year	10.00
4 waists	made at home	1 year	3.00
2 white petticoats	made at home	1 year	2.00
1 silk dress, $15	made at home	1 year	15.00
1 black petticoat	.....	1 year	.75
2 winter union suits	.....	1 year	2.00
2 summer union suits	.....	1 year	1.00
6 corset covers	made at home	1 year	1.50
3 corsets	.....	1 year	3.00
2 gowns	made at home	1 year	1.00
3 pairs drawers	made at home	1 year	.90
10 pairs hose	.....	1 year	2.50
12 handkerchiefs	.....	1 year	1.20
Gloves	.....	1 year	2.00
4 pairs shoes	.....	1 year	12.00
Ribbons, etc	.....	1 year	1.50
Furs, $20	.....	2 years	10.00
Total			$95.85

(Father pays only $50 of this amount)

The family has relatives from whom it often receives clothing that can be made over.

Washing

The family washing, with the exception of a few shirts and collars, is done by the mother.

Soap, bluing, starch, etc.	$10 a year
Laundry	2 a year
Total	$12 a year

Clothing Budget for a Business Girl

(Living at home and assisted by the family in making garments and repairs)

The salary is about $15 a week, and the need is for good, everyday garments. The suits are made by a dressmaker outside of the home; the coat is ready-made; and other clothing is made at home as far as possible. Advantage is taken of past-season sales. The long, light-weight coat is serviceable all the year. The coat of the three piece winter suit serves when a short coat is desired. The cost is, on an average, $100 annually. This plan of budget making considers the possible service of garments as continuing from year to year.

Budget for Business Girl's Clothing for Three Years

		Number	Total Cost	Years of Wear	Average Yearly Cost (Omitting Small Fractions)
Suit—3 piece, for winter: Coat, skirt, waist. Suiting material, serge—16 yds. 36 in. at $1.25–$20 (12 yds. 50 in. at $1.50)	$20.00	1			
Lining—Sateen, 4 yds. 36 in. at $.50	2.00				
Interlinings, trimmings, etc.	6.00				
Dressmaker	20.00		$48.00	3	$16.00
Coats—Covert cloth: Long, light-weight, ready-made		1	20.00	3	6.66
Sweater		1	3.50	3	1.17
Dresses — summer (each summer a new one. This lasts over the next summer):					
Ginghams (in washable colors) 10 yds. 30 in. at $.25	2.50	1			
Dressmaker	5.00		7.50	1	7.50
Batiste, etc.:		1			
10 yds. 36 in. at $.25	2.50				
Dressmaker	7.00		9.50	2	4.75
Carried forward			$88.50		$36.08

From "Textiles" by Woolman and McGowan.

		Number	Total Cost	Years of Wear	Average Yearly Cost (Omitting Small Fractions)
Brought forward.....			$88.50		$36.08
Separate waists (made at home).....					
Cotton.....		3			
3 yds. 36 in.at $.15....	.45				
Trimming (average for 3).....	.15		1.80	1	1.80
Scotch flannel.....		1			
3 yds. at $.35.....	1.05		1.05	1	1.05
Silk:					
5 yds. at $.75.....	3.75	2	7.50	3	2.50
Dress skirts(made at home)					
Wool (Panama).....		1			
5 yds. 36 in. at $1.....	5.00		5.00	2	2.50
Cotton.....		1			
5 yds. (30–36 in.)at $.15	.75		.75	1	.75
Petticoats:					
Sateen, 5 yds. at $.35...	1.75	1	1.75	2	.88
Colored cotton, 5 yds. at $.15.....	.75	1	.75	1	.75
White cotton 4 yds. at $.15.....	.60	2	3.20	3	1.10
Embroidery or Lace....	1.00				
Corset covers:		4			
1¼ yds. at $.15.....	.20				
Lace or embroidery....	.30		2.00	1	2.00
Nightdresses:		3			
4 yds. at $.15.....	.60				
Trimming.....	.40		3.00	2	1.50
Carried forward			$115.30		$50.91

		Number	Total Cost	Years of Wear	Average Yearly Cost (Omitting Small Fractions)
Brought forward			$115.30		$50.91
Drawers:		2			
1¾ yds. at $.15	.28				
Trimming (average)	.30		1.16	1	1.16
Hats:					
Winter		1	8.00	1	8.00
Summer		1	5.00	1	5.00
Gloves:					
Kid	1.25	2	2.50	1	2.50
Silk	.50	2	1.00	1	1.00
Chamoisette	.50	2	1.00	1	1.00
Corsets		1 or 2	2.00	1	2.00
Hosiery, 9 pr. at 3 for $1		9	3.00	1	3.00
Shoes, 3 pr. at $4 each		3	12.00	1	12.00
(or 4 pr. at $3 average)					
Rubbers, 2 pr. at $.75 each		2	1.50	1	1.50
Underwear:					
Cotton shirts, $.25		4	1.00	1	1.00
Combinations, $1 (heavy)		3	3.00	2	1.50
			$156.46		$90.57
Sum left for extras					9.43
Total					$100.00

INDEX

Absorbent cotton, 14
Accessories, Soap, 112
Acetic acid, 15
Acid, 15
  action on linen, 98
  dyes, 21
  effect on animal fibers, 107
  effect on vegetable fibers, 106
  hydrochloric, 86
Acid test, Nitric, 61
  tannic, 78
Acidulated water, 58
Action of acids, 15, 98
  of alkalies, 16, 98
Adulterated silk, 86
Agents, Bleaching, 17
Alcohol, 120
Alkalies, 16
  action on linens, 98
  effect on animal fibers, 107
  effect on vegetable fibers, 107
Alkali test, 58, 60
Alum, 117
Ammonia, 17
Aniline dyes, 23
  bluing, 114
Animal fibers, Effect of acids on, 107
  effect of alkalies on, 107
Artificial bleaching stuffs, 17
  silk, 86
Art linen, 98

Baling cotton, 9
Bargain, What is a, 175
Basic dyes, 21
Bast fiber, 93
Batiste, 25
Batten, Cotton, 11
Battening, 5
Beams, 6
Bed linen, 100
Bengaline, 73
Blanket wools, 33
Bleach, 113
Bleaching agents, 17, 126
  linen, 95
  sulphur dioxide, 128

Block printing, 23
Blood stains, 121
Bluing, 113
  aniline, 114
  Indigo, 114
  Prussian, 114
  test for presence of iron, 114
  ultramarine, 115
Boiling in lye solution, Materials before and after, 57, 59, 60
Bombyx mori, 66
Borax, 109
Bottle for pressing seams, 119
Braking flax, 93
Broadcloth, 32, 39
Brocaded satin, 73
Budget, Clothing, 184
  business girl, 190
  family, 185
Burning to detect cotton, 56
  weighting in silk, 82
Butcher's linen, 99

Calendering cloth, 12, 20
Calico, 24
Cambric, 25
Carbona, 120
Carbonated or caustic alkalies, 16
Carbon tetrachloride, 120
Carding, 11, 36, 37
Care of clothing, 148, 182
Carpet wools, 33
Cash and charge systems, 179
Cashmere, 31
Cellulose, 15
Characteristics of cotton, Physical, 12
  of silk fiber, 76
Chardonnet silk, 87, 88
Charge systems, 179
Chemical characteristics of silk fiber, 76, 78
  nature of cotton, 14
  test for cotton and wool, 56
Chemicals, Effect of, on fiber, 14
Cheviots, 62
Chiffon, 73
China silk, 73
Chloride of lime, 17
Chloroform, 120
Citrates, 15
Cleaning cotton, 11
  white kid gloves, 127
  white shoes, 127
Clothes, Hanging, 130
  soiled, 150
Clothing budget, 184, 190

Clothing, care of, 148, 182
economics of, 163
function of, 142
hygiene of, 141
keeping clean, 148
objects of, 144
Cocoa stains, 122
Coffee stains, 122
Collars, 158
Collodion silk, 89
Colors, To set, 116
selection of, 172
Combing, 11, 37
Common cotton materials, 24
linen fabrics, 98
silk materials, 73
Compared with price, Wearing qualities, 27
Comparison of different varieties of wool, 31
Conduction of heat and electricity by wool, 34
Corduroy, 25
Corsets, 149, 150
Cortex of wool, 32
Cotton, 1, 6
bleaching, 17
burning to detect, 56
chemical nature of, 14
Cotton,
cleaning, 11
distinguishing between linen and, 102
fibers, Types of, 13
for undergarments, 146
hygroscopicity of, 146
materials, Common, 24
mercerized, 18, 21
Crash, 98
Cream stains, 122
Crêpe de Chine, 74

Damask, 98
French, 100
German, 99
Difference between hair and wool, 32
Different varieties of wool compared, 31
Dimity, 25
Discharge process of printing, 24
Distinguishing between cotton and linen, 102
Dotted Swiss, 29
Drawing cotton, 11
wool, 38
Dressing economically, 166
Dressing in cotton, 27
Drying flax, 93
woolens, 131

Dyeing, 12, 21, 35, 38, 70
Dyes, response of linen to, 98
test for fastness, 64

Economical dressing, 166
Economics of clothing, 163
Effect of, acids on animal fibers, 107
acids on vegetable fibers, 106
acids on wool, 34
alkalies on animal fibers, 107
alkalies on vegetable fibers, 107
alkalies on wool, 34
chemicals on cotton fiber, 15
Eiderdowns, 61
Elasticity of wool, 34
Electric iron, 138
Electricity, linen conductor of, 97
wool conductor of, 34
Epidermis of wool, 31
Evolution of spinning, 1
of weaving, 1
Experiment on mercerized cotton, 21
on wool, 56

Fabrics, Common linen, 98
Fading, Tests for fastness to, 64
Family budget, 185
washing, 190
Fashion, Effect on wool supply, 42
Fastness to dyes, crocking, and fading, Tests for, 64
perspiration, 26
sunlight, 25
washing, 26
Felting property of wool, 32
Fermentation, Cotton liable to, 14
Fiber, Bast, 93
effect of acids on vegetable and animal, 106, 107
effect of alkalies on vegetable and animal, 107
effect of chemicals on cotton, 15
flax, 97
physical and chemical characteristics of silk and linen, 76, 96
test for quality of, 29
types of cotton, 13

Fibroin, 68, 78
Finishing woolens, 39
Firmness of weave, 52
Flannels, 63
Flax fibers, 97
  culture, 92
  in different stages of preparation for weaving, 91
  spinning, 94
Fleeces, 37
Floss, Silk, 70
Foulard, 74
French damask, 100
Fruit stains, 122
Functions of clothing, 142

Garments, One-piece, 157
  ready-made, 167
  worn at night, 160
Gasoline, 120
German damask, 99
Gingham, 24
Ginning cotton, 9
Glass toweling, 99
Gloves, What to buy, 169
Glycerine, 122
Gossypium, 6
Grass stains, 125
Grease, 119
  wagon, 121

Habutai, 74
Hackling flax, 93
Hair and wool, Difference between, 32
Half ripe cotton fibers, 13
Hand cards, 36
Handkerchief linen, 99
  to wash, 135
Hanging clothes, 130
Hardness of water, Temporary and permanent, 109
Hard soap, 111
  water, 108
Hats, 159, 174
Heat conduction, of cotton, 14
  of linen, 14, 97
  of wool, 34
Heddle, 6
Homemade soap, 111
Household linen, 99
Huckaback, 99
Hydrochloric acid, 86
Hygiene of clothing, 141
Hygroscopicity of cotton, 14, 146
  silk, 146
  wool, 33, 146

Imported silks, 73
Indigo blue, 114
Ink stains, 124

Insects, Cotton resistant to, 14
Iodine or medicine stain, 125
Irish linen, 99
Iron, Electric, 138
  rust, 123
Iron in bluing, Tests for, 114
Ironing, 130

Javelle water, 17, 126, 128
John Brown linen, 99

Laces, To wash, 134
Laundry, Coöperative, 139
  machinery, 135
  problems, 104
  soaps, 112
Laws, Pure textile, 46, 82
Leash, 6
Leather goods, What to buy, 169
Length of wool fibers, 33
Lime in soap, 111
Linen, 90
  action of acids and alkalies upon, 98
  art, 98
  bed, 100
Linen,
  bleaching, 17, 95
  butcher's, 99
  conductor of heat and electricity, 97
  distinguishing between cotton and, 102
  dyeing, 22
  fabrics, Common, 98
  fiber, Physical and chemical characteristics of, 96, 145
  French damask, 100
  German damask, 100
  handkerchief, 99
  heat conduction of, 14
  household, 99
  Irish, 99
  John Brown, 99
  luster, 97
  response to dyes, 98
  Scotch, 99
  sizing, 96
  table, 99
  tests of, 102
  toweling, 101
  undergarments, 146
  weaving, 94
Long-staple wools, 33
Loom, 5
Louisine, 74
Luster of wool, 33
Lye in soap, 110

Machinery for laundry, 135
Machines, Power, 138
  washing, 135
Maline, 74
Mangles, 137
Materials before and after boiling in lye, 57, 59, 60
  common silk, 73
Mature cotton fiber, 13
Meal, Cottonseed, 9
Meat juice stains, 121
Medicine stains, 125
Mending, 183
Mercerized cotton, 18, 19
  test for, 21
Mildew, 14
  removal of, 125
Milk spots, 122
  stains, 122
Mineral acids, 15, 16
Miscellaneous wools, 33
Mixed cotton and wool, chemical test, 56
Moiré, 74
Mold, 125
Mordants, 12, 21, 22, 78, 116
  reaction of linen toward, 98
Moths, Cotton resistant to, 14
Mousseline de Soie, 74
Mucus stains, 121
Mulberry silkworm, 66
Mull, 25
Muslin, 24

Nainsook, 25
Naphtha soap, 120
Nap of wool goods, Raising, 119
Napping, 40
Natural dyestuffs, 22
Neutralizing solution, 17
Night, Garments worn at, 160
Noils, 37

Oil, Cotton, 9
One-piece garments, 157
Organic acids and salts, 15, 16
Organdie, 25
Oxalic acid, 15

Paint stains, 121
Parts of loom, 5
Peau de Soie, 75
Percale, 25
Percentage of shrinkage, Test for, 27
Permanent hardness of water, 109

Perspiration, Effect of, on silk, 80
test for fastness to, 26
Physical characteristics of cotton, 12
characteristics of silk fiber, 76
properties of textiles, 145
Picking, 5, 9
Piqué, 25
Planting cotton, 7
Plush, 75
Pongee, 66, 75
Power machines, 138
Presence of iron in bluing, Test for, 114
Pressing seams with bottle, 119
Price, Wearing qualities compared with, 27
Printing, 23
Prussian blue, 114
Pure silks before and after burning, 83, 86
Pure textile laws, 46

Quality of fiber, Test for, 29
of wool, 30

Raddle, 6
Raising nap of wool goods, 119
Rajah, 75
Raw silk, 67
Ready-made garments, 167
Reagent for cleaning, 120
Reasons for washing, 105
Reed, 6
Reeled and waste silk, 71
Reeling, Silk, 69, 71
Removing stains, 118
Resist process of printing, 24
Retting flax, 93
Rhubarb, 15
Rinsing colored clothes, 117
Rippling flax, 93
Rubbers, 154
Rust, Iron, 123

Sales, 176
Saltpeter, 117
Salts of organic acids, 15
Salt to set colors, 116
Sateen, 25
Satin, 75
brocaded, 73
Skinner's, 75
Scotch linen, 99
Scrim, 25
Scutching flax, 93
Serges, 63
Sericin, 68, 78

Set colors, To, 116
Sewing, Knowledge of, 181
Shearing, 35
Shedding, 5
Shepherd checked materials, 55, 61
Shields, 149
Shoddy, 43, 63
Shoes, 153, 169, 183
Shopping, 180
Short-staple wools, 33
Shrinkage of wool, 32
  test for percentage of, 27
Shuttle, 4, 6
Silk, 66
  adulterated, 86
  artificial, 86
  Chardonnet, 87, 88
  China, 73
  dyeing, 22, 70
  fiber, Physical and chemical characteristics of, 76
  finish, 20
  floss, 70
  hygroscopicity of, 146
  imported, 73
  manufacture in the United States, 72
  materials, 73
  pure, 83, 86
Silk,
  reeled and waste, 69, 71
  wash, 86
  weighting, 70, 78, 83
Silkworm, 66, 72
Sizing linen, 96
Skirts, long, 158
Sleeping bags, 161
Slivers, 37
Soap, 110
  homemade, 111
  laundry, 112
  substitutes, 112
Soda, Washing, 109
Softening hard water, 109
Soft water, 108
Soiled clothes, 150
Solutions of acids, 15
Solvents, 120
Sorting wool, 37
Specifications, War Department, 47
Spinning cotton, 11
  evolution of, 1
  flax, 94
  wool, 38
Sprinkling clothes, 131
Stains, 17
  blood, 121
  cocoa, 122
  coffee, 122
  cream, 122

Stains,
fruit, 122
grass, 125
grease, 119
ink, 124
iodine, 125
meat juice, 121
medicine, 125
milk, 122
mucus, 121
removing, 118
tea, 122
varnish, 121
Stockings, Selection of, 156, 170
Strengthening threads, 12
Strength of materials, Test for, 28
of wool, Tensile, 34, 53
Substantive dyes, 21
Substitutes for soap, 112
Sugar of lead, 117
Sunlight, Test for fastness to, 25
Swiss, Dotted, 29

Table linen, 99
Taffeta, 75
Tannic acid, 78
Tapa cloth, 2
Tartrates, 15
Teasel, 39
Tea stains, 122
Temporary and permanent hardness of water, 109
Tensile strength of wool, 34, 53
Tenterhooks, 6
Tests for crocking, 26, 64
dressing in cottons, 27
fading, 64
fastness to dyes, 64
fastness to perspiration, 26
fastness to sunlight, 25
fastness to washing, 26
iron in bluing, 114
linen, 102
mercerized cotton, 21
percentage of shrinkage, 27
quality of fiber, 29
strength of materials, 28
War Department, 48
weighting, 82
woolen materials, 51
Textile laws, 46, 82
Thin fiber, 13
Thread, 11
Throwing the shuttle, 4
Tops, 33
Toweling, 101
Tulle, 76

Tussah silk, 66
Types of cotton fibers, 13

Ultramarine blue, 115
Union suits, 158

Varieties of wool, Comparison of, 31
Varnish stains, 121
Vegetable fibers, Effect of acids on, 106
effect of alkalies on, 107
Veils, 159
Velvet, 76
Velveteen, 25
Vinegar, 15, 58
Virgin wool, 62
Viyella flannel, 63

War Department specifications, 47, 48
Warp and weft, 55, 58
Warp shed, 4
Washing compounds, 113
family, 190
handkerchiefs, 135
hanging clothes, 130
laces, 134
reasons for, 105
soda, 109
test for fastness to, 26
when to wash, 129
woolens, 131
Waste in wool manufacture, 43
silk, 71
Water, Hard and soft, 108
Wearing qualities compared with price, 27
Weaving, 12, 38
evolution of, 1
firmness, 52
flax, 91
linen, 94
Weighting silk, 70, 78, 83
What is a bargain? 175
White gloves, To clean, 127
White shoes, To clean, 127
Wool, 30
as conductor of electricity, 34
blanket, 33
carding, 36, 37
carpet, 33
chemical test, 56
combing, 37
cortex, 32
difference between hair and, 32
drawing and spinning, 38
dyeing, 22, 35, 38

Wool,
effect of acids and alkalies on, 34
elasticity of, 34
epidermis, 31
felting property of, 32
finishing, 39
fleeces, 37
for undergarments, 146
goods, To raise the nap of, 119
hygroscopicity of, 33, 46
length of fibers, 33
long-staple, 33
luster of, 33
medulla, 32
miscellaneous, 33
napping, 40
noils, 37
quality of, 30
Wool,
shearing, 35
shoddy, 43
short-staple, 33
shrinkage of, 32, 35, 40
slivers, 37
sorting, 37
tensile strength of, 34
tops, 33
varieties compared, 31
weaving, 38
Woolen materials, Tests for, 51
yarn, 41
Woolens, To wash, 131
Worsted cheviots, 63
yarn, 41

Yarn, woolen, 41
worsted, 41